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CONTENTS.

Page

Ardagh, J. *See* **Renkema**, H. W.

Bandulska, **Helena**, A.R.C.S., M.Sc., Ph.D., F.L.S. A Cinnamon from the Bournemouth Eocene. (Plate **8**, and 7 Text-figures.) 139

—— On the Cuticles of some Recent and Fossil Myrtaceæ. (Plates **39** & **40**, and 24 Text-figures.) 657

Bélliėre, **Marcel**. *See* **Leclercq**, **Suzanne**.

Bose, S. R., D.Sc., F.L.S., F.R.S.E. Biology of Wood-rotting Fungi common in Forest Areas. (Plates **22–25**, and 1 Text-figure.) 417

Brown, N. E., A.L.S. The South African Iridaceæ of Thunberg's Herbarium 15

Good, R. D'O., M.A., F.L.S. The Taxonomy and Geography of the Sino-Himalayan Genus *Cremanthodium* Benth. (Plates **9–13**.) 259

Groves, **James**, F.L.S. On Charophyta collected by Mr. Thomas Bates Blow, F.L.S., in Madagascar. (Plates **4–7**.) 125

Hill, Sir **Arthur** W., C.M.G., F.R.S. *See* **Summerhayes**, V. S.

Holden, H. S., D.Sc., F.L.S. Some Observations on the Wound Reactions of *Ankyropteris corrugata*. (Plate **38**, and 16 Text-figures.) 643

Howarth, W. O., M.Sc., F.L.S. The Genus *Festuca* in New Zealand. (With 23 Text-figures.) 57

Leclercq, Dr. **Suzanne**, et **Bėllière**, **Marcel**. *Psygmophyllum Gilkineti*, sp. n., du Dévonien moyen à *facies* Old Red Sandstone de Malonne (environs de Namur, Belgique). (Communicated by Dr. D. H. **Scott**, F.R.S.) (Plates **1–3**.) 1

Page

Lyle, Lilian. Marine Algæ of some German Warships in Scapa Flow and of the Neighbouring Shores. (With 9 Text-figures.) 231

Marquand, C. V. B., M.A., F.L.S. The Botanical Collection made by Captain F. Kingdon Ward in the Eastern Himalaya and Tibet in 1924–25 149

Nelmes, E. *See* Sprague, T. A.

Prankerd, T .L., D.Sc., F.L.S. Studies in the Geotropism of Pteridophyta. —IV. On Specificity in Graviperception. (Plates **14** & **15**.) 317

Pugsley, H. W., B.A., F.L.S. A Revision of the British *Euphrasiæ*. (Plates **26–37**.) 467

Renkema, H. W., and Ardagh, J. Aylmer Bourke Lambert and his 'Description of the Genus *Pinus*' 439

Scott, Dr. D. H., F.R.S. *See* Leclercq, Dr. Suzanne, and Bellière, M.

Sprague, T. A., D.Sc. F.L.S. The Herbal of Otto Brunfels 79

Sprague, T. A., D.Sc., F.L.S., and Nelmes, E. The Herbal of Leonhart Fuchs 545

Summerhayes, V. S., B.Sc. A Revision of the Australian Species of *Frankenia*. (Communicated by Dr. A. W. Hill, C.M.G., F.R.S.) (Plates **16–19**, and 7 Text-figures.) 337

Thomas, H. Hamshaw, M.B.E., Sc.D., F.L.S., F.G.S. Further Observations on the Cuticle Structure of Mesozoic Cycadean Fronds. (Plates **20** & **21**, and 13 Text-figures.) 389

EXPLANATION OF THE PLATES.

PLATE

1–3. *Psygmophyllum Gilkineti*, sp. n.
4. *Nitella inæqualis*, sp. n. *N. graciliformis*, sp. n.
5. *Nitella sphærocephala*, sp. n. *N. mucronata* var. *mobilis*, nov. *N. vermiculata*, sp. n.
6. *Nitella Blowiana*, sp. n.
7. Oospore membranes of *Nitella* spp.
8. *Cinnamomum* from the Bournemouth Eocene
9–13. *Cremanthodium* Benth.
14. Graviscripts for presentation time of *Asplenium* spp. and *Osmunda* spp.
15. Graviscripts for latent time of *Asplenium* spp. and *Osmunda* spp.
16. Australian species of *Frankenia*.
17. *Frankenia magnifica* Summerh. *F. annua* Summerh.
18. *Frankenia planifolia* Summerh.
19. *Frankenia bracteata* Summerh.
20–21. Mesozoic Cycadean fronds.
22–25. Wood-rotting Fungi.
26. *Euphrasia micrantha* and *E. scotica*.
27. *Euphrasia latifolia* and *E. foulaensis*.
28. *Euphrasia rotundifolia* and *E. Marshallii*.
29. *Euphrasia curta* and *E. cambrica*.
30. *Euphrasia occidentalis* and *E. nemorosa*.
31. *Euphrasia nemorosa*.
32. *Euphrasia confusa* and *E. Pseudo-Kerneri*.
33. *Euphrasia borealis*.
34. *Euphrasia brevipila*.
35. *Euphrasia brevipila* and *E. Rostkoviana*.
36. *Euphrasia montana*, *E. rivularis*, and *E. anglica*.
37. *Euphrasia anglica*, *E. hirtella*, and *E. salisburgensis*.
38. Wound reactions of *Ankyropteris corrugata*.
39. Cuticles of *Rhodomyrtus* spp.
40. Cuticles of *Tristania* spp.

ERRATA.

Page

17, line 21, *for* Ker. ex Baker *read* Ker ex Baker.

20, line 7, *for* N. E. Brit. *read* N. E. Br.

118, *for* P. Bistorta *read* Polygonum Bistorta; *for* P. Persicaria *read* Polygonum Persicaria, *and for* P. lapathifolium *read* Polygonum lapathifolium.

194, line 9 from bottom, *for* LACTUA *read* LACTUCA.

202, line 9 from bottom, *for* Mazim. *read* Maxim.

477, line 14, *for* seeen *read* seen.

507, line 15, *for* larger *read* longer.

512, line 5 from bottom, *for* subequante *read* subæquante

525, line 1, *for* enarginate *read* emarginate.

527, line 11, for *rivalaris* read *rivularis*.

THE JOURNAL

OF THE

LINNEAN SOCIETY OF LONDON.

(BOTANY.)

Psygmophyllum Gilkineti, sp. n., du Dévonien moyen à *facies* Old Red Sandstone de Malonne (environs de Namur, Belgique). Par le Dr. SUZANNE LECLERCQ, Chef de Travaux à l'Université de Liège, et M. BÉLLIÈRE, Ingénieur Géologue. (Communicated by Dr. D. H. SCOTT, F.R.S., F.L.S.)

(Plates **1-3.**)

[Read 5th January, 1928.]

Etude géologique et stratigraphique du gisement.

(Par M. BÉLLIÈRE.)

L'ÉCHANTILLON qui a fourni la matière du présent travail provient d'une petite exploitation de grès Couvinien à Malonne, au lieu dit "La roche" *. C'est un des nombreux affleurements qui jalonnent la bande Couvinienne du bord sud du synclinal de Namur.

L'excavation, à flanc de coteau, large de 4 à 5 mètres seulement, a entamé des bancs de grès rouge ou jaune verdâtre, irréguliers, qui sont utilisés comme moellons à batir. Du côté nord de la carrière, les premiers bancs non exploités forment une paroi redressée constituée de schistes grossiers et de grès argileux rouges. Tandis que les bancs exploités ne sont pas fossilifères, ceux-ci, au contraire, sont localement très riches en végétaux plus ou moins bien étalés suivant la stratification*. Leur enchevêtrement peut même donner à certains blocs l'aspect des "murs" du Houiller. Toute trace de matière carbonée a disparu ; néanmoins, les empreintes sont, dans certains cas, remarquablement conservées, étant donné la texture assez grossière de la roche. Le végétal décrit a été extrait d'un grès argileux rouge mal stratifié parcouru par de nombreuses diaclases irrégulières. L'extraction systématique de ses divers fragments et leur repérage ont permis la reconstitution de l'échantillon remarquable qui figure dans les collections de Paléontologie végétale de l'Université de Liège †.

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* Cet endroit est appelé dans le pays "Su l'rotche," et la traduction de la carte topographique est peut-être erronée, car ce terme pourrait signifier "Sur le rouge," le terrain de la bande couvinienne étant en grande partie teinté en rouge, teinte qui se retrouve dans la terre meuble qui le recouvre.

Stratigraphie.—Le Couvinien repose en discordance de stratification sur le Silurien de la bande de Sambre et Meuse, dont il existe de nombreux affleurements dans les environs, notamment dans le fond d'Insepré. Le contact est même visible dans une petite carrière abandonnée, à 1400 m. à l'Est de l'exploitation citée.

Le Couvinien débute par un poudingue à gros éléments, à ciment clair, jaune verdâtre, dont l'épaisseur est d'environ deux mètres. Les bancs sont renversés et assez redressés, comme c'est la règle dans tout le bord sud du synclinal de Namur ; l'inclinaison dans la zone décrite est de 62° sud en moyenne. La carrière qui a fourni l'échantillon ne montre pas le poudingue, mais celui-ci forme un beau mur naturel, en relief, à 150 m. environ, à l'est. La direction des bancs étant très régulière, il est facile de prolonger la bande de poudingue jusqu'à l'affleurement intéressé.

Le poudingue, dont la présence est très constante vers l'est, fait défaut localement, à l'ouest ‡, notamment dans le chemin de Malpas vers Babin, où, à 600 m. de l'affleurement étudié, on observe le contact du Couvinien et du Silurien sans poudingue, avec présence d'une sorte de conglomérat schisteux à très petits éléments. Il semble qu'à ce point une certaine partie du Couvinien soit supprimé par une faille §.

Abstraction faite de cette anomalie, les affleurements voisins de la petite carrière montrent, superposés stratigraphiquement au poudingue, quelques mètres de grès de textures et de teintes très variables. Ces grès peuvent être psammitiques, argileux ou quartzitiques, fins ou un peu grossiers et même peuvent contenir localement de petits éléments schisteux. Leur teinte est grise, verdâtre, jaunâtre, rosée ou rouge et un même banc présente des teintes diverses sur une faible distance. Les bancs les plus durs sont utilisés comme pierre à bâtir. La formation gréseuse renferme des intercalations parfois assez épaisses de schiste rouge ou jaune verdâtre. L'épaisseur totale est de 15 à 20 mètres.

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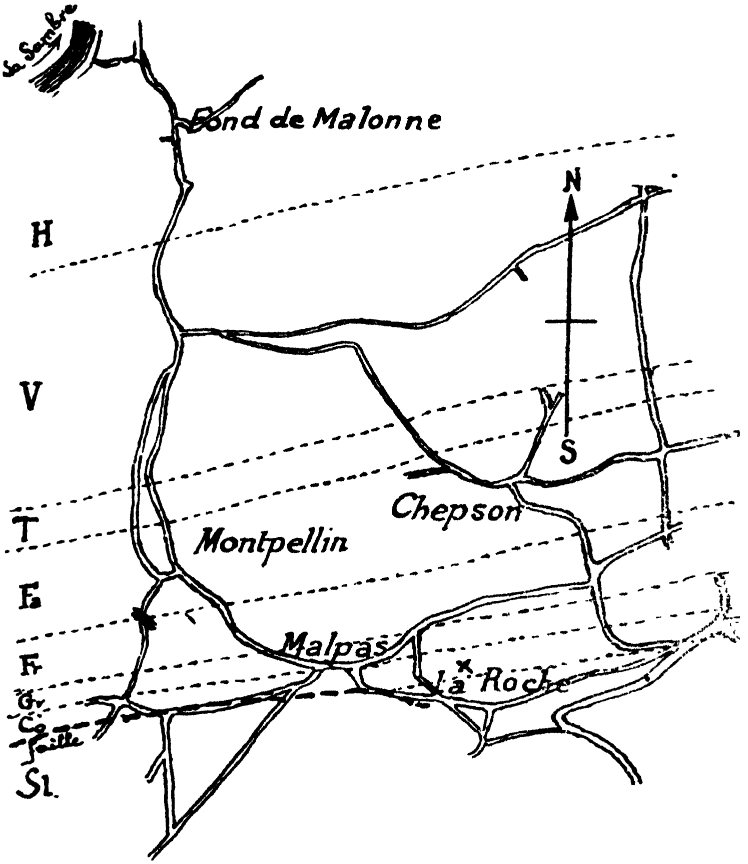
* Le professeur Fraipont a signalé provenant de ce gisement : *Psilophyton* cf. *robustus* (Ann. Soc. Géol. de Belgique, Bull. xliii (1920) p. 130). Voir aussi : M. Béllière, "Découverte de *Psygmophyllum* dans le Couvinien" (Livre Jubilaire de la Soc. Géol. de Belgique in 4to, T. ii, p. 144, 1924).

† Qu'il me soit permis d'exprimer tous mes remercîments à M. le Professeur Ch. Fraipont, qui a bien voulu mettre à ma disposition les ressources de son laboratoire et de son personnel pour la récolte de l'échantillon et sa reconstitution.

‡ de Dorlodot, "Compte-rendu de l'excursion de la Société Belge de Géologie à Namur les 14, 15 et 16 août, 1889," Bull. Soc. Belge de Géol. t. iii, 1889. Béllière, "Compte-rendu de la session extraordinaire de la Société Géologique de Belgique à Namur, du 22 au 24 sept., 1923," Ann. Soc. Géol. de Belgique, xlvi.

§ Stainier, "Le Couvinien du Bassin de Namur," Bull. Soc. Belge de Géol. xxxvi, 1926, p. 118.

TEXTE-FIG. 1.



Carte à l'échelle du 1 : 20,000 des environs de l'affleurement. Les traits interrompus indiquent les limites de terrains qui sont représentés par leurs initiales, soit :— Sl., Silurien ; Co., Couvinien ; Gv., Givetien ; Fr., Frasnien ; Fa., Famennien ; T., Tournaisien ; V., Viséen ; H., Houiller.

La formation gréseuse est recouverte stratigraphiquement par des schistes rouges qui deviennent de plus en plus fins quand on s'élève dans la série. Les bancs inférieurs sont schisto-gréseux ou psammitiques. Les schistes altérables sont peu visibles, ils ne manifestent leur présence que par la couleur rouge qu'ils communiquent aux labourés. Ils forment le passage au Givetien, et, de ce fait, il est assez difficile de déterminer l'épaisseur de la formation couvinienne. Au voisinage de l'endroit étudié, on peut observer le calcaire givetien à une centaine de mètres au nord de la base de la formation schisteuse. Ce sont les bancs supérieurs de la formation gréseuse qui sont exploités dans l'excavation décrite plus haut. Les végétaux s'observent dans les bancs de passage à la formation schisteuse, bancs qui, en raison de leur moindre dureté, ne sont pas exploités.

La carte ci-contre (texte-fig. 1) indique la situation de l'affleurement (marqué par une croix) et l'allure de la bande couvinienne par rapport aux terrains du bord sud du Synclinal de Namur.

Etude paléontologique du Psygmophyllum Gilkineti, sp. n.

(Par Suzanne Leclercq.)

Il sera donné dans cette étude un aperçu de la distribution stratigraphique et géographique du genre *Psygmophyllum* ; la description objective du fossile, puis, basée sur cette description, la détermination spécifique. Celle-ci sera suivie d'une discussion de la définition du genre *Psygmophyllum* et d'un exposé des caractères morphologiques externes qui différencient la nouvelle espèce présentée des espèces déjà décrites; enfin, en conséquence, les termes de la diagnose du *Psygmophyllum Gilkineti* seront arrêtés.

Distribution stratigraphique et géographique du genre Psygmophyllum.

Jusqu'ici, on n'a, à ma connaissance, signalé la présence de *Psygmophyllum*[*] que dans le Dévonien inférieur du Spitzberg[†], dans le Dévonien moyen de Norvège[‡], dans le Dévonien supérieur de Perry Maine, U.S.A.[§], de Seaumenae Bay, Dalhousie, Canada[§], de la Mimersthal au Spitzberg[||], dans le Carboniférien inférieur ou Dévonien supérieur de Terre Neuve[¶], dans le Carboniférien de Pennsylvanie[**], dans le Westphalien moyen d'Angleterre[††], dans le Permo-Carbonifère du Sud Africain[‡‡], soit donc *du Dévonien inférieur au Permien.*

La présence certaine d'un *Psygmophyllum*, à port suffrutescent ou peut-être arborescent, à la base du Dévonien moyen est des plus interessante, attendu que les spécimens décrits jusqu'ici font supposer pour la plupart un port de petite plante herbacée. Les dimensions exceptionnelles atteintes par *P. Gilkineti* permettent d'entrevoir la vigueur que pouvaient déjà présenter certaines espèces dans ces temps reculés.

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[*] Arber (1912) propose, pour plus de facilité dans les déterminations, de réserver le terme *Psygmophyllum* aux feuilles à limbe entier ou légèrement lobé (ex., *P. flabellatum* Lindley et Hutton, *P. majus* Arber) ; et de désigner sous le nom de *Gingkophyllum* les feuilles profondément lobées ou découpées (ex., *P. Grasserti* Saporta, *P. Hollandi* Seward, *P. Haydeni* Seward). Quoique cette distinction soit arbitraire et sans aucune valeur botanique, nous l'adopterons et ne renseignerons comme *Psygmophyllum* que les échantillons présentant les caractères requis à défaut de classification plus systématique.

[†] Arber (1921), p. 56.

[‡] Nathorst (1915)—*Psygmophyllum Kolderupi* Nath.

[§] Dawson (1862) (1871)— *Cyclopteris Browni* Daws.

[||] Nathorst (1894)—*Psygmophyllum Williamsoni* Nath.

[¶] Arber (1912)—*Psygmophyllum majus* Arb.

[**] Lesquereux (1880)—*Archæopteris obtusa* Lesq.

[††] Howse (1888)—*Psygmophyllum flabellatum* Lindley et Hutton, sp. ; Lindley et Hutton (1831)—*Noegerathia flabellata* Lind. et Hut.

[‡‡] Seward (1903)—*Psygmophyllum Kidstoni* Seward,

Description de l'échantillon.

L'échantillon comprend la portion terminale d'un végétal ligneux arborescent ou suffrutescent accompagné d'empreintes isolées de quelques fragments de larges feuilles pétiolées, plus ou moins fragmentées. L'ensemble des axes* et des feuilles qui y sont fixées mesure 55 centimètres de haut sur 95 cm. de large.

L'axe.

A première vue, le végétal paraît être formé d'un seul axe (A et B, Pl. **1**. fig. 1), long de 21 cm., garni de feuilles nombreuses (vingt-deux) longuement pétiolées et disposées en spirale.

Un examen plus attentif de l'échantillon, révèle la présence d'un petit fragment d'axe de second ordre (B', Pl. **1**. fig. 1), long de 5 cm. seulement, prolongé par une esquille d'axe sur une longueur de 8 cm. En prolongeant celle-ci, il est aisé de la rattacher vers le tiers du grand axe dont nous avons parlé (Pl. **2**, trait noir, et Pl. **1**. fig. 1). On constate alors qu'au niveau de l'insertion de l'axe secondaire sur le grand axe, il y a disproportion entre les diamètres de deux portions contiguës de cet axe. La largeur de l'axe tombe subitement de 5 cm. à 2·5 cm. Cette anomalie s'explique aisément par la présence d'une ramification.

L'échantillon se compose, non pas d'un axe unique assez long comme on pouvait le supposer à première vue, mais d'un axe principal long de quelques centimètres seulement, se divisant en deux axes secondaires (Pl. **1**. fig. 1, et Pl. **2**, trait noir).

L'axe principal A ne mesure en réalité que 7½ centimètres ; large de 4 cm. à la base, son diamètre croît sur cette longueur de 1 cm. Cet accroissement de diamètre est provoquée par la division des éléments ligneux de l'axe, prêts à s'individualiser en deux axes de moindre importance, mais de valeur presqu'égale.

Immédiatement au-dessus de cette région s'effectue la division de l'axe principal. Elle manque sur l'échantillon, par suite d'un très malencontreux éclat de la roche à cet endroit, ce qui rend l'interprétation difficile. Aussi, l'individualisation des deux axes secondaires, B et B', doit-elle être reconstituée pour devenir apparente (voir Pl. **2**, traits noirs).

Le rameau de droite (B) est presque entièrement conservé ; long de 14 cm., son diamètre est de 2½ cm. à la naissance de la ramification et décroît normalement vers le sommet, où il se réduit à 1½ cm. Il porte de nombreuses feuilles (neuf), dont la disposition spiralée est quelque peu voilée par l'absence de feuilles sur toute la longueur, du côté gauche de son empreinte.

---

* L'état de conservation de l'échantillon ne permet pas de se rendre compte s'il représente un rameau d'ordre secondaire d'un végétal arborescent ou plutôt un fragment de la tige principale d'une plante suffrutescente. Je désignerai sous le terme général d'axe les éléments ligneux du végétal.

Le rameau de gauche (B′ 4) a tout particulièrement souffert de la disparition de la région indiquant la division de l'axe principal. Il est réduit, comme nous l'avons déjà dit, à un bout d'axe de 5 cm. de long, large de 2 cm. et distant de 13 cm. de son point d'attache (Pl. **1.** fig. 1).

Il est heureusement prolongé sur une longueur de 8 cm. par l'extrême bord gauche de l'empreinte de son axe, ce qui établit une continuité indiscutable entre ce fragment isolé et le moignon de ramification à peine indiqué sur l'axe principal (voir Pl. **2**, trait noir ; Pl. **1.** fig. 1 et Pl. **3**. fig. 3).

La contre-empreinte de cet axe secondaire (Pl. **3**. fig. 6) a été trouvée conservée, sur l'envers d'un fragment de roche portant à l'endroit l'empreinte de la feuille figurée Pl. **3**. fig. 1 *.

En superposant le dessin de la contre-empreinte sur la projection de l'axe secondaire gauche (B′ °), tel qu'il apparaît sur le bloc principal, on parvient à prolonger l'axe jusqu'à un demi centimètre à peine de l'axe principal et à indiquer d'une façon certaine le niveau de la ramification et son allure (Pl **2**, trait rouge).

La longueur réelle de l'axe secondaire gauche (B′) est, de ce fait, connue ; elle atteint 17 cm. ; son diamètre varie entre 2·5 cm. au niveau de la division de l'axe principal et 1 cm. au sommet.

La contre-empreinte de l'axe secondaire gauche a été schématisée et reproduite en rouge de Pl. **2**. La juxtaposition des feuilles 20 *b′* et 21 *b′* de l'empreinte et de la contre-empreinte a permis d'orienter l'axe et ses feuilles avec certitude.

La texture de la roche est telle qu'il est difficile de se rendre compte si la surface des trois axes présente ou non des traces de striation.

Les feuilles.

A eux seuls, les trois axes portent 22 feuilles, pour la plupart réduites au pétiole. Elles sont réparties comme suit : quatre sur l'axe principal, huit ou neuf sur l'axe secondaire droit et neuf sur le fragment de l'axe secondaire gauche (voir Pl. **2**).

Toutes révèlent une disposition spiralée ; aussi trouve-t-on des empreintes de feuilles en connexion probable avec ces axes à différents niveaux dans la roche.

De nombreux fragments de feuilles isolées, intéressantes par certains détails de structure, complètent le matériel.

Les feuilles, par suite de la longueur exceptionnelle du pétiole, peuvent atteindre 45 cm.

Le limbe est entier, coriace et flabelliforme ; long de 10 à 14 cm., large de 10 à 15 cm. au sommet. Le bord supérieur (Pl. **3**. fig. 4) est entier ou largement, mais peu profondément, lobé ; la base se rétrécit brusquement

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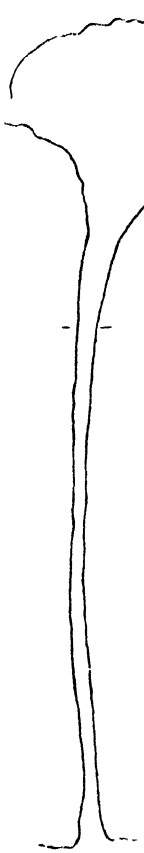
* Cette feuille, vu la longueur habituelle des pétioles, devait s'insérer sur une portion inférieure de l'axe principal qui n'a pas été conservée.

(Pl. 3. fig. 5) pour se continuer par le pétiole. Les bords latéraux sont réguliers. La nervation en général peu nette, par suite de la nature gréseuse et grenue de la roche, paraît plus accentuée à la base du limbe que dans les régions moyenne et supérieure, où les nervures sont fines, denses et presque parallèles.

Une des caractéristiques des feuilles du *Psygmophyllum Gilkineti* est la longueur du pétiole qui peut atteindre 33 cm. Ce fait est exceptionnel

TEXTE-FIG. 2.



Reconstitution d'une feuille type de *Psygmophyllum Gilkineti*, sp. n., s'insérant sur le côté droit de l'axe principal. La reconstitution a été faite au moyen du pétiole de la feuille 2 *a* et du limbe de la feuille 5 *b*. Les deux petits traits horizontaux indiquent les points de raccordement. (Un quart de la grandeur naturelle.)

chez *Psygmophyllum*. Les espèces décrites jusqu'ici possèdent bien des feuilles continuées par une gaine foliaire plus ou moins longue, plus ou moins engainante, mais, jamais, elle n'atteint les dimensions remarquables du pétiole de *P. Gilkineti*. Chez celui-ci la longueur des pétioles varie de 20 à 33 cm.; les plus longs appartiennent aux feuilles de position inférieure;

les plus courts aux feuilles situées au sommet des axes. Quoique long et mince, il présente une grande rigidité et tient haut dressé le limbe qui le termine. La fig. 3, Pl. **3**, est très démonstrative à cet égard, elle donne une idée exacte du port de la plante, elle montre des feuilles à grand limbe étalée autour des axes en un large éventail dont les rayons sont les pétioles minces et droits.

Les Pl. **1**. fig. 1 et Pl. **3**. fig. 3 indiquent clairement le mode très simple d'insertion des pétioles sur les axes : les quatre feuilles de l'axe principal A (1 *a*, 2 *a*, 3 *a*, 4 *a*) s'insèrent presque perpendiculairement à celui-ci, leur angle d'insertion est un angle droit (voir Pl. **2** et Pl. **1**. fig. 1) ; l'angle d'insertion des feuilles (5 *b*, 8 *b*, 10 *b*, 11 *b*, 12 *b*) de l'axe secondaire droit B varie suivant la position qu'elles occupent; il devient de plus en plus petit chez les feuilles qui se rapprochent du sommet. Il suffit de comparer l'angle d'insertion des feuilles 5 *b*, 8 *b*, 10 *b*, 11 *b* et 12 *b* pour s'en convaincre.

Sur l'axe secondaire gauche, B′, l'angle d'insertion des feuilles, est très aigu, aussi peut-on supposer, quoique l'extrémité de l'axe manque, qu'on est en présence de la portion terminale d'une ramification. (Comparer l'angle d'insertion des feuilles 17 *b′*, 18 *b′*, 20 *b′*, 21 *b′*, 22 *b′* de l'axe secondaire droit B (Pl. **2** et Pl. **1**. fig. 1) avec celui des feuilles 12 *b*, 11 *b*, 10 *b*, 8 *b*, 5 *b*.)

La contre-empreinte de l'axe B′ (Pl. **3**. fig. 6) donne d'ailleurs de précieux renseignements à ce sujet. Elle montre l'axe garni de 7 pétioles dont 5 sont en connexion avec lui. L'angle d'insertion de ces pétioles est petit et devient presque nul pour les feuilles du sommet (voir Pl. **3**. fig. 6 et Pl. **2**, traits rouges).

La Pl. **1**. fig. 2 représente un groupe isolé de trois feuilles. Le parallélisme des pétioles et l'enchevêtrement des limbes font supposer que ces feuilles n'ont pas été transportées très loin de l'axe sur lequel elles s'inséraient, l'une près de l'autre certainement. Aussi, est-il fort probable qu'elles étaient en connexion avec la fronde décrite et qu'elles n'en ont été détachées qu'à la suite de la formation des profondes diaclases qui sillonnent la roche (voir Pl. **3**. fig. 3, côté gauche du cliché).

Aucune des nombreuses feuilles du fossile n'étant conservée dans son entiereté, j'ai cru intéressant de reconstituer une feuille type en associant le limbe et le pétiole de deux feuilles différentes chez lesquelles ces parties étaient les plus complètes. A cet effet, la fig. 2 du texte montre réduite au quart de sa grandeur naturelle l'aspect probable que devait présenter une feuille de *Psygmophyllum Gilkineti*.

Détermination.

De la description objective qui précède, on peut conclure que par leur limbe flabelliforme, rétréci à la base, élargi et légèrement lobé à l'apex, ainsi que par leur nervation parallèle, dichotome et rayonnante, les feuilles du végétal étudié correspondent parfaitement à la diagnose instituée par Schimper pour le genre *Psygmophyllum*.

Comme on le sait, Schimper a créé ce genre* pour de larges feuilles cunéiformes provenant du Carbonifère supérieur et du Permien d'Angleterre et dont les formes représentatives furent classées en premier lieu dans le genre *Noeggerathia* par Lindley et Hutton †.

Schimper donne la diagnose suivante :—"Folia pinnatisecta, pinnis erecto-patentibus, e basi valde angusta flabelliformibus (unde nomen), longitudinaliter flabellatim plicatis, plus minus profunde pinnatisectis, vel margine lobatis seu crenatis ; nervis pluries dichotomis, erecto-radiantibus. Vernatio foliorum verticaliter involuta (Sec. Eichwald)."

Le végétal décrit dans ce travail rentre donc bien dans le genre *Psygmophyllum*.

Quelques considérations sur les caractères morphologiques externes du Psygmophyllum Gilkineti, *sp. n.*

De l'étude paléontologique qui précède, on peut conclure que l'intéret que présente *P. Gilkineti* réside en trois points :—

(1°) En ce qu'il appartient au genre *Psygmophyllum*, dont on connaît tres peu de chose ;

(2°) En ce qu'il possède un axe ligneux vigoureux et ramifié ;

(3°) En ce qu'il provient d'un gisement nettement situé à la base du Dévonien moyen.

Reprenons chacun de ces points et voyons avec plus détail la portée de chacun d'eux :—

(1) Le genre *Psygmophyllum* est des plus artificiel ; rarement rencontré dans les roches sédimentaires, les quelques spécimens trouvés ne sont connus que par des empreintes. On ignore tout de leur structure anatomique et de leurs organes reproducteurs. Le port même de ces végétaux est incertain : Représentent-ils des plantes herbacées, atteignent-ils la taille des plantes suffrutescentes ou même arborescentes ? Si mal connu que la position systématique du genre est des plus incertaine ‡, la découverte d'échantillons

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* Schimper (1870), vol. ii, p. 192.

† Lindley et Hutton (1831), pp. 89–90.

‡ Arber, dans "On *Psygmophyllum majus*, sp. n., from the Lower Carboniferous of Newfoundland," etc., cite p. 404 différentes opinions émises par des auteurs ayant décrit des *Psygmophyllum*. Certains les classent parmi les Palmiers ; d'autres, entre les Ginkgoales et les Cycadinées ; d'autres encore, parmi les Fougères, les Gymnospermes, les Ginkgoales, les Cycadées. Devant une telle divergeance de vues et l'impossibilité momentanée de trancher la question, Arber propose, par raison de prudence, de ranger les *Psygmophyllum* sous le nom de Paleophyllales (*Palaios* = ancien, *Phullon* = feuille). Cette terminologie a sur les autres l'avantage de n'impliquer aucune relation des classes de végétaux bien établies avec les *Psygmophyllum*, qui ne présentent avec elles que des affinités encore trop hypothétiques. J'adopte dans ce travail les vues d'Arber.

nouveaux de *Psygmophyllum* constitue donc une heureuse trouvaille, permettant d'espérer un nouvel apport de données susceptibles de faire cesser quelques-unes des nombreuses incertitudes qui entourent ces végétaux.

(2) La diagnose du genre *Psygmophyllum* établie par Schimper, au temps où on les rangeait parmi les Cycadinées, ne cadrant plus, par omission de certains caractères avec les nouveaux spécimens trouvés, Arber *, dans son intéressant travail sur *P. majus*, propose de corriger comme suite cette diagnose :—

"Leaves large, flabellate or cuneiform, arranged spirally on an axis, sheathing at the base, which is fairly broad and not contracted to a slender petiole. Apex broad, rounded or truncated, entire or toothed, or broadly lobed or slightly divided into broad palmate lobes. Nerves radiating from the base with frequent dichotomy throughout the lamina, and not converging above.

"*Distribution in Time.* Upper Devonian to Permian."

Et Arber omet d'introduire dans sa diagnose un caractère nouveau et important que présente *P. Kidstoni* Sew., dont il parle cependant dans son travail. *P. Kidstoni* possède "a fairly stout axis." Or, la présence d'un axe ligneux vigoureux, long de 34 cm. et de feuilles non engainantes, confère à cette espèce un port du végétal suffrutescent ou même arborescent au cas où le fossile serait un fragment de fronde plus complexe. Ces caractères distinguent suffisamment, il me semble, *P. Kidstoni* des Palæophyllales herbacées, à axe frêle et étroitement engainé par les bases longuement décurrentes des feuilles (tels *P. flabellatum* Lind. et Hut. ; *P. obtusa* Lesq.; ? *P. Kolderupi* Nath.) pour mériter une mention dans la diagnose générale du genre remanié par Arber.

Il est évidemment regrettable que M. Seward † n'ait pas attiré davantage l'attention sur la présence d'un axe ligneux important chez *P. Kidstoni* et n'ait pas donné une description plus détaillée de ses caractères. Mais, maintenant que la découverte du *P. Gilkineti*, avec son axe ligneux vigoureux et ramifié et ses feuilles longuement pétiolées, non engainantes, vient souligner l'existence de types à port suffrutescent ou arborescent chez certaines espèces du genre *Psygmophyllum*, il est nécessaire de mentionner ces caractéres dans la diagnose du genre. Aussi, je propose de transformer comme suit la diagnose établie par Arber :—

"Leaves large, flabellate or cuneiform, *sheathing or not at the base*, arranged spirally on a slender axis, *sometimes fairly stout and ramified. Base of the lamina sometimes fairly broad and not contracted to a slender petiole, sometimes suddenly contracted to a long and thin petiole.* Apex broad, rounded or truncated, entire or toothed, or slightly lobed. Nerves radiating from the base with frequent dichotomy throughout the lamina and not converging above."

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* Arber (1912), p. 397.

† Seward (1903), p. 95.

"*Distribution in Time.* ? Lower Devonian to Permian" *.

De ce qui précède, il ne faudrait pas conclure cependant que *P. Gilkineti* peut se confondre avec *P. Kidstoni.* Si ces deux espèces possèdent, l'une comme l'autre, un axe ligneux important et des feuilles non engainantes, les feuilles longuement pétiolées et à limbe flabelliforme du *P. Gilkineti* diffèrent grandement des feuilles cunéiformes du *P. Kidstoni.* Chez celui-ci, le limbe, parfois profondément divisé en deux lobes, se termine en pointe et s'attache directement à l'axe sans pétiole.

C'est avec les feuilles du *P. majus* (Arber) que *P. Gilkineti* présente le plus de ressemblance. La grandeur et la forme en éventail du limbe de leurs feuilles sont fort analogues :—

P. majus : longueur du limbe dépassant 16 cm.
largeur „ „ 15 cm.
P. Gilkineti : longueur du limbe de 10 à 14 cm.
largeur „ „ de 10 à 15 cm.

La nervation des feuilles de *P. majus* est d'une netteté remarquable ; celle de *P. Gilkineti,* comme nous l'avons déjà signalé, est, de par la nature de la roche, diffuse ; toutefois il semble qu'elle soit plus dense que celle présentée par les feuilles du *Psygmophyllum* de Terre Neuve.

Enfin, *P. Gilkineti,* par son port, son axe ligneux ramifié et ses feuilles pétiolées non engainantes, diffère grandement des Palæophyllales herbacées, tels que *P. flabellatum* et *P. obtusa,* ainsi que des petites espèces comme *P. Kolderupi.*

(3) J'ai déjà signalé dans la distribution stratigraphique et géographique du genre *Psygmophyllum* (p. 4) l'intérêt qu'offre la présence *certaine* d'un *Psygmophyllum* à port suffrutescent ou peut-être arborescent à la base du Dévonien moyen. Le spécimen signalé par Nathorst dans le Dévonien inférieur † de Spitzburg est très hypothétique et celui du Dévonien moyen de Norvège (*P. Kolderupi*) appartient à une espèce de petite taille dont les feuilles atteignent à peine 15 à 30 millimètres de large.

Le seul *Psygmophyllum* présentant un port analogue à celui de *P. Gilkineti,* le *P. Kidstoni* (Sew.), provient d'un étage très supérieur : le Permo-Carbonifèrien de l'Afrique du Sud. Jusqu'ici il eut été permis de considérer *P. Kidstoni* comme un type très évolué, descendant directement des Palæophyllales herbacées situées dans des étages géologiques inférieures. Mais la présence du *P. Gilkineti* si vigoureux, à un niveau aussi bas que le Dévonien moyen, heurte cette manière de voir et fait saisir combien plus complexe est la question de l'évolution de ces végétaux. On se trouve en présence d'un *Psygmophyllum* de la base du Dévonien moyen, qui, par les caractères de son axe ramifié et de ses feuilles longuement pétiolées, est plus évolué qu'un *Psygmophyllum* du Permo-Carbonifère. Si déconcertantes que puissent paraître ces constatations, il ne faut pas oublier que les spécimens étudiés ne sont que fragmentaires. Peut-être, l'un d'eux représente-t-il une portion de végétal suffrutescent (par ex., *P. Gilkineti*), l'autre une extrémité d'un rameau de plante arborescente (*P. Kidstoni*). Dans ce cas, l'abîme apparent existant entre ces deux espèces disparaîtrait, et l'on serait amené à rechercher la souche initiale de ces deux espèces parmi les Palæophyllales de petite taille ayant vécu pendant le Dévonien inférieur ou plus tôt encore, et qui nous sont jusqu'à présent inconnues.

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* Feuilles grandes, flabelliformes ou cunéiformes, engainantes ou non, disposées en spirale autour d'un axe grêle, parfois aussi vigoureux et ramifié. Base du limbe plutôt large, dépourvue de vrai pétiole ou brusquement contractée et continuée par un pétiole long et mince. Apex large. arrondi ou tronqué, entier (?) dentelé ou largement mais peu profondément lobé. Nervures s'irradiant de la base du limbe, non convergeantes au sommet et offrant de fréquentes dichotomies.

Répartition stratigraphique: Dévonien inférieur au Permien.

† Arber (1912), p. 56.

Quoiqu'il en soit, la découverte du *P. Gilkineti* est au point de vue de l'évolution du règne végétal des plus intéressante. Nos connaissances en plantes arborescentes et suffrutescentes relevées dans des terrains aussi anciens sont jusqu'ici plutôt réduites. Elles se bornent aux *Palæopitys Milleri*, *Aneurophyton germanicum*, *Calamophyton primævum*. Si les découvertes et les recherches futures prouvent, comme le pensent beaucoup de palæontologues *, que les Palæophyllales sont des Proto-Gingkoales à graines, l'existence d'une Gymnosperme primitive telle que *P. Gilkineti* placera leur apparition à un niveau sensiblement plus bas que celui qui leur est généralement attribué jusqu'ici, c'est à dire le Dévonien supérieur ou le Carboniférien.

Et, si l'on admet, au contraire, qu'un jour les *Psygmophyllum* se révèleront appartenir par leur fructification aux Crytogames vasculaires, le problème n'en sera pas moins intéressant; on pourra les considérer alors comme les ancètres probables des Conifères si abondants dans le Secondaire.

Conclusions générales.

Par S. LECLERCQ et M. BÉLLIÈRE.

En conclusion de nos observations, nous donnons du *Psygmophyllum Gilkineti* la diagnose suivante :—

Végétal arborescent ou tout au moins suffrutescent. Axe ligneux, ? lisse, ramifié, garni de feuilles nombreuses, distantes, non engainantes, disposées en spirale. Feuilles grandes, coriaces et longuement pétiolées. Limbe flabelliforme, de 10 *à* 14 *cm. de longueur et de* 10 *à* 15 *cm. de largeur, plus large à l'apex qu'à la base où il se rétrécit brusquement ; bords latéraux réguliers ; apex arrondi, entier ou largement mais peu profondément lobé. Nervation peu nette* † *; nervures parallèles s'irradiant de la base du limbe au sommet par de (?) fréquentes dichotomies.*

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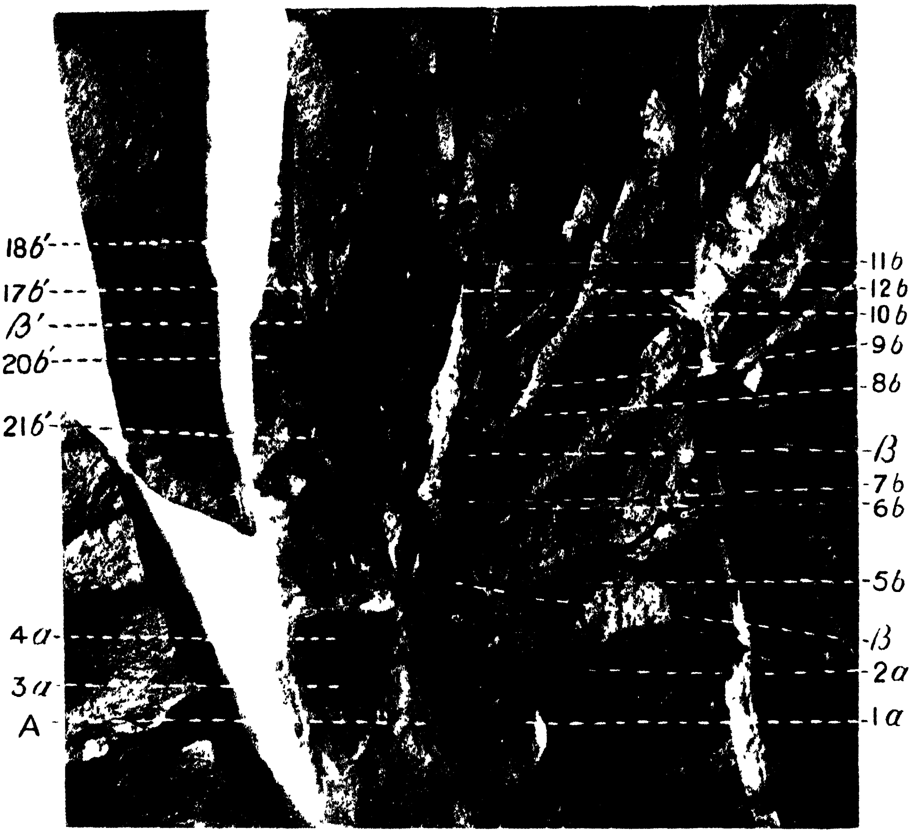
* Arber (1912), p. 404.

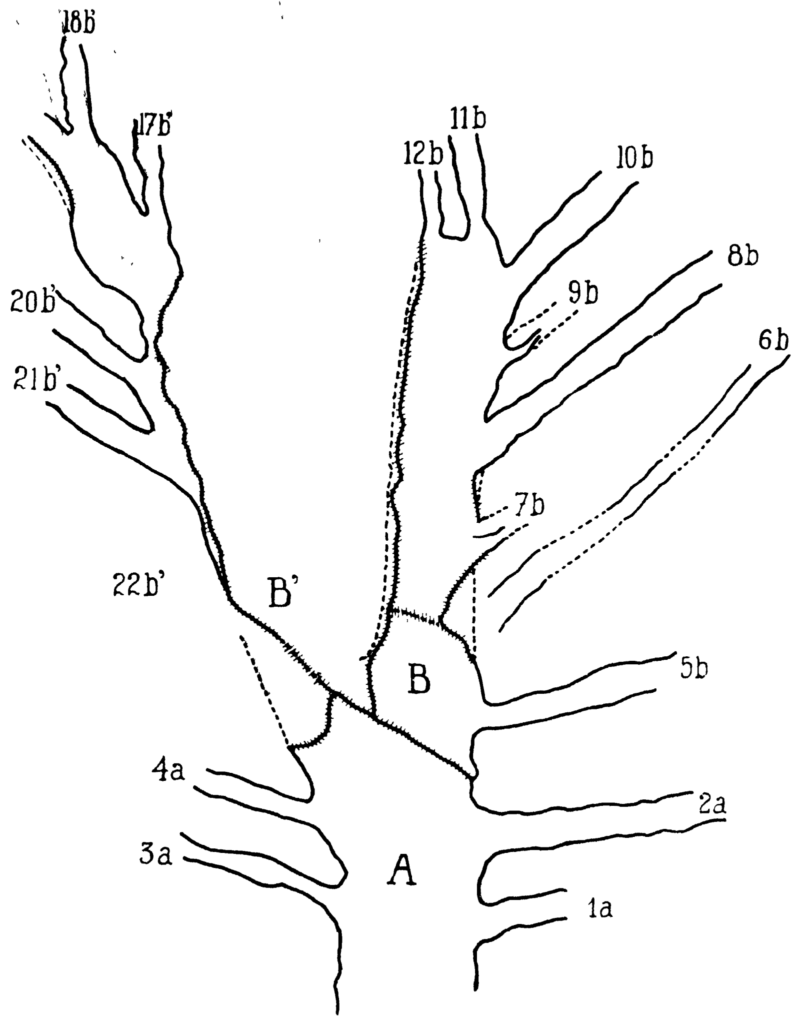
† Par suite de la nature gréseuse et grenue de la roche.



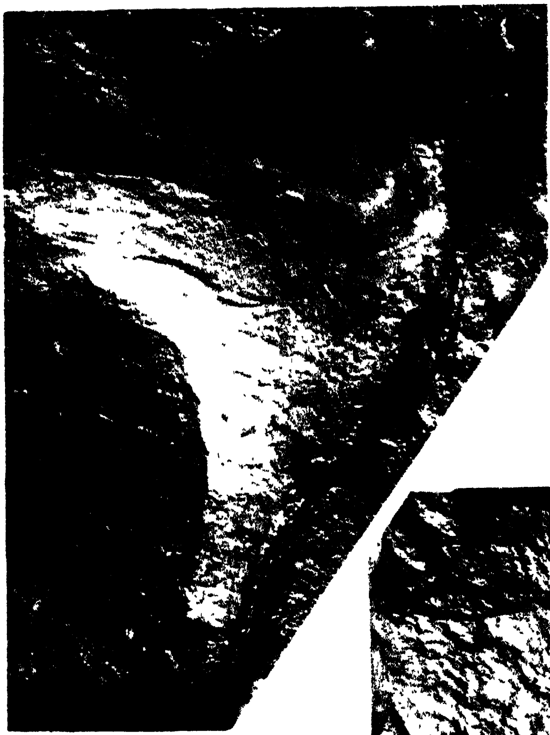
1

2

PSYGMOPHYLLUM GILKINETI. sp. n.



PSYGMOPHYLLUM GILKINETI, sp. n.



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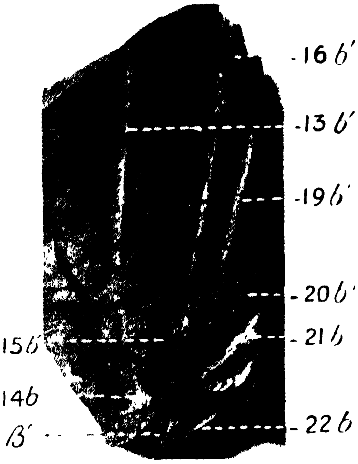

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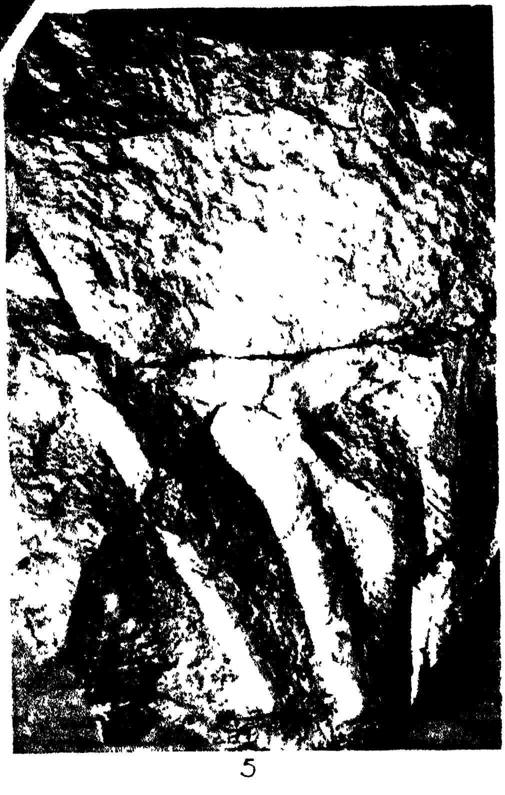

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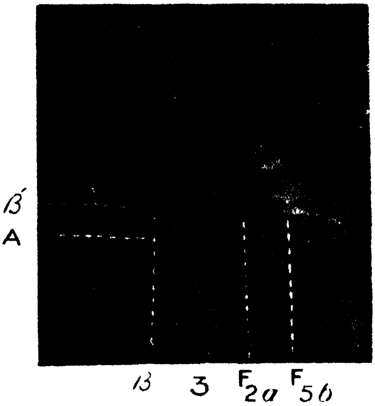

3

PSYGMOPHYLLUM GILKINETI. sp n.

Limbe prolongé par un pseudo-pétiole long de 20 à 33 cm. s'amincissant de la base du limbe à son point d'insertion sur l'axe. Angle d'insertion variant suivant la position des feuilles sur l'axe. Nervures parallèles, fines, continuant celles du limbe.

Position stratigraphique: Dévonien moyen à facies Old Red Sandstone (Couvinien? de Malonne, Province de Namur, Belgique).

Echantillon type No. 14350 des collections de Paléontologie végétale de l'Université de Liège.

Nous dédions cette nouvelle espèce à notre savant et regretté maître, Alf. Gilkinet, en mémoire de ses beaux travaux de paléontologie végétale.

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EXPLICATION DES PLANCHES.

Les photographies, sauf la Pl. 3. fig. 3, prise dans la carrière par M. Béllière, ont été faites par M. Louis Julin, chef de travaux à l'Université de Liège. Je lui adresse ici tous mes remercîments.

PLANCHE 1.

Fig. 1. *Psygmophyllum Gilkineti*, sp. n. Axe ligneux principal (A) ramifié en deux axes secondaires (*β* et *β'*) garnis de 16 feuilles, dont on ne voit sur cette figure que les pétioles, la photographie ne montrant qu'une partie de l'échantillon. $\frac{1}{3}$ grandeur naturelle.

A. Axe principal portant les quatre feuilles, 1 *a*, 2 *a*, 3 *a*, 4 *a*.

β. Axe secondaire droit portant huit feuilles, 5 *b*, 6 *b*, 7 *b*, 8 *b*, 9 *b*, 10 *b*, 11 *b*, 12 *b*.

β'. Axe secondaire gauche garni de quatre feuilles, 17 *b'*, 18 *b'*, 20 *b'*, 21 *b'*.

Fig. 2. Groupe isolé de trois feuilles presque complètes, montrant trois pétioles parallèles et trois limbes fortement imbriqués les uns sur les autres. Un peu moins de $\frac{1}{3}$ grandeur naturelle.

PLANCHE 2.

Reconstitution en demi grandeur des axes feuilles du *Psygmophyllum Gilkineti*, sp. n.

Les traits noirs pleins donnent le détail de l'échantillon tel qu'il apparaît sur la roche encaissante. Les traits rouges représentent la contre-empreinte de l'axe secondaire gauche superposé au positif. Ils montrent, de façon indiscutable, la ramification à peine esquissée sur l'empreinte, ainsi que la juxtaposition des feuilles 20 *b'* et 21 *b'* de la empreinte et de la contre-empreinte.

A. Axe principal.
β. Axe secondaire droit.
β'. Axe secondaire gauche réduit à un fragment prolongé vers l'axe principal par son extrême bord gauche.
Feuilles de l'axe principal : 1 *a*, 2 *a*, 3 *a*, 4 *a*.
Feuilles de l'axe secondaire droit : 5 *b*, 6 *b*, 7 *b*, 8 *b*, 9 *b*, 10 *b*, 11 *b*, 12 *b*, ? 13 *b*.
Feuilles de l'axe secondaire gauche : 14 *b'*, ? 15 *b'*, 16 *b'*, 17 *b'*, 18 *b'*, 19 *b'*, 20 *b'* ; (empreinte et contre-empreinte) 21 *b'*, 22 *b'*.

Les traits pleins donnent les limites exactes de ce qui apparaît sur la roche.

Les traits hachurés indiquent les parties brisées de l'échantillon.

Les traits interrompus représentent la restitution probable des parties de l'échantillon enlevées par les éclats de la roche.

PLANCHE 3.

Fig. 3. Vue d'ensemble du *Psygmophyllum Gilkineti*, sp. n., prise dans la carrière même. Les axes et les feuilles longuement pétiolées sont bien visibles. Environ $\frac{1}{36}$ grandeur naturelle.

A. Axe principal.
β. Axe secondaire droit.
β'. Axe secondaire gauche.
F 2 *a*. Feuille dont le pétiole a servi à la reconstitution de la fig. 2 du texte.
F 5 *b*. Feuille dont le limbe a servi à la reconstitution de la feuille hypothétique fig. 2 du texte.

4. Limbe presque entièrement conservé de la feuille 5 *b*. L'apex est légèrement mais peu profondément lobé. La nervation est fine et très dense. $\frac{1}{2}$ grandeur naturelle.
5. Large limbe dont l'apex manque ; la base se rétrécit brusquement et se continue par le pétiole. Un peu moins de $\frac{1}{2}$ grandeur naturelle.
6. Contre-empreinte d'un fragment de l'axe secondaire gauche, montrant une portion de l'axe garni de 7 feuilles. Représenté par les traits rouges dans la reconstitution de la Pl. 2. Environ $\frac{1}{6}$ grandeur naturelle.

The South African Iridaceæ of Thunberg's Herbarium.

By N. E. Brown, A.L.S.

[Read 17th November, 1927.]

Carl Pehr Thunberg was born in 1743, and in due course became a pupil of Linné, and afterwards Professor of Botany at Upsala. He made voyages to South Africa, Java, and Japan, and after his return published an account of his travels and described the plants he had collected. He sailed from Europe on Dec. 30, 1771, and landed at Cape Town on April 17, 1772, the journey occupying fifteen weeks, in contrast with the three weeks it now takes to accomplish.

Thunberg stayed in South Africa nearly three years, and sailed to Java on March 2, 1775. During his stay in South Africa he made three extensive journeys into various parts of it, and in two of them was accompanied by Francis Masson, who was sent to collect living plants for the Royal Botanic Gardens at Kew, and who first introduced many of the South African plants that now adorn our gardens and greenhouses.

Thunberg sent or brought back from the Cape a large collection of dried plants which he had discovered, and described them in numerous separate pamphlets and in his 'Prodromus Plantarum Capensium' and 'Flora Capensis.' Many were described also by the younger Linné.

This fine collection, consisting of well-dried specimens, is now preserved in the Botanic Garden at Upsala, and I am indebted to Prof. Juel and his predecessors for the privilege of being able to examine various portions of it. The collection forms the basis of our knowledge of South African plants, and it is necessary to consult it when accurate determinations of any South African group of plants have to be made. Having been asked to work out the Iridaceæ for Dr. Burtt Davy's 'Flora of the Transvaal,' I considered it necessary to examine Thunberg's types of the species he had described, some of which are stated by Baker in the 'Flora Capensis' to grow in the Transvaal. As Thunberg was never nearer than about 400 miles from that region—for he only travelled eastwards through the coastal and subcoastal Divisions, and north and north-westward as far as the Doorn River and the Roggeveld in Calvinia Division,—and as the Transvaal has quite a different flora from that of the parts where Thunberg travelled, I much doubted the correctness of some of the determinations.

My examination of Thunberg's types justified my suspicion, and the result of that examination is recorded in the following account of them. I have redescribed some of the species, and have restored and re-characterised the genera *Dietes* and *Helixyra* proposed by Salisbury, which have not hitherto been acknowledged, although clearly distinct from *Moræa* and *Iris*, under which they have been placed. I would also draw attention to the fact that although most of the ground over which Thunberg collected has been traversed by several (and in some parts by many) collectors, there are many species in Thunberg's Herbarium that appear not to have been rediscovered during the 152 years that have elapsed since he collected them.

As an instance of the rarity of some South African plants, I may mention that Dr. John Muir, of Riversdale, informs me that he discovered a species of *Mesembryanthemum* at a locality within sight of his house, but has never been able to find it again. Many years ago a collector informed me that when he visited Dr. Atherstone (at that time a resident at Grahamstown), the doctor told him that in the previous year (about 1860) not far from his house he saw a bulb in flower in abundance which he had never seen previously during the many years he had lived there, and although he took the collector to the spot where it grew they failed to find it.

As a few of Thunberg's species are still unknown, or at least are not represented in the Kew Herbarium, it is unfortunate that Thunberg did not indicate the localities where he gathered the specimens, for, as a rule, no locality is marked on the sheets in his herbarium. On the back of each sheet the words "*e Cap. bonæ spei.* Thunberg" are written, but very rarely is the exact locality given. As localities are often mentioned by Thunberg in his 'Flora Capensis,' he must have kept some separate record of them.

While examining Thunberg's specimens it became evident—as had been noticed to be the case in other orders in his herbarium—that the types of the very numerous species described in Linné's 'Supplementum Plantarum' (1781), with Thunberg cited as the collector, must have been in Thunberg's Herbarium, for there are no specimens of most of them in the Linnean Herbarium. There are, however, in the Linnean Society's Smithian Herbarium, with which the younger Linné's Herbarium is incorporated, some specimens received from Thunberg in 1791, ten years after the names were published. As the specific names published by the younger Linné and those published by Thunberg for the same plant are identical, except in a few instances, it would seem that Thunberg lent his specimens to Linné for description. In a few cases, as for instance on the sheets of *Moræa* * *flexuosa*, the name is written in what appears to me to be the handwriting of Linnæus. So, in all cases where no specimen received from Thunberg prior to 1781 is in the Linnean or Smithian Herbaria, Thunberg's specimen must be accepted as the type of the species, as indicated in the following pages.

The sheets on which the specimens are mounted are marked under each species either with Greek letters, α, β, γ, δ, &c., or with consecutive numbers. Often, however, the different sheets under one name contain different species, and it is not always sheet *a* or sheet 1 that can be accepted as the type-specimen of the species. In such a case the type-specimen must be the one that best fits the description.

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* Concerning the correct spelling of this name (which should be *Morea!*), see below under *Iris tristis*.

With reference to the new combinations of names in the following enumeration, it may be of interest to mention two works that are probably unknown to South African botanists as a source of such name-changes. These are :—

(1) ASCHERSON and GRAEBNER. Synopsis der Mitteleuropaischen Flora, vols. i–vi (1896–1910).

(2) DRUCE, G. C. Second Supplement to Botanical Society and Exchange Club Report for 1916 (July 1917).

Each of these books contains numerous changes of nomenclature for plants from all parts of the world.

In the following enumeration the genera and species are all arranged in alphabetical order, and the comparisons made are noted in Kew Herbarium.

ANTHOLYZA L.

A. ÆTHIOPICA Thunb. Prodr. 7 (1794). Three sheets :—

α is **Acidanthera tubulosa** Baker. It is not an *Antholyza* and not like "*A. plicata* Thunb." as named by Klatt.

β. **Antholyza** resembling *A. caffra*, but has less acute bracts.

γ. **Antholyza caffra** Ker. ex Baker.

A. CUNONIA Thunb. Prodr. 7 (1794). One sheet.

This is **Antholyza cunonia** L.

A. IMMARGINATA Thunb. MS. Never published by Thunberg, but described as a variety of *A. æthiopica* L. by Baker in Fl. Cap. vi, 167. Two sheets :—

α. This has a stout branching inflorescence, and the much curved stout upper part of the perianth-tube is not truncate at its base, but narrows into the slender portion, just as dried flowers of *A. præalta* Redoute commonly do. I believe Thunberg's specimen to be a vigorous example of **A. præalta** Redoute.

It is certainly not *Anisanthus splendens* Sweet, as named by Klatt, nor *Antholyza æthiopica* L., as named by Baker.

β. **Antholyza immarginata** Thunb. ex Baker.

A. æthiopica var. *immarginata* Baker.

A. LUCIDOR Thunb. Prodr. 7 (1794). One sheet.

Is **Antholyza lucidor** Linn. f. and matches the Linnean type.

A. MARGINATA Thunb. in Mus. Nat. Upsal. Append. xxii, 27 (1814), name only. One sheet.

It is **Watsonia angusta** Ker, not *Antholyza æthiopica* Gawl., as named by Klatt.

A. NERVOSA Thunb. Prodr. 7 (1794). One sheet, the type of this species.

A. PLICATA Thunb. Prodr. 7 (1794). Two sheets.

Both are **Babiana Thunbergii** Ker, and are identical with the type of *Antholyza plicata* Linn. f. (1781). The specific name was changed by Ker, because he had used the still earlier name of *Ixia plicata* L. (1756) = *Gladiolus plicatus* L. (1762) for another species of *Babiana.*

A. RINGENS Thunb. Prodr. 7 (1794). One sheet.

This is **Babiana ringens** Ker, and matches the type of *Antholyza ringens* L. (1753).

A. SPATHACEA Thunb. in Mus. Nat. Upsal. Append. xxii, 27 (1814), name only.

This is *Watsonia Pillansii* L. Bolus, according to a label placed on the sheet by Mrs. Bolus. It differs, however, from *W. Pillansii* by the leaves being more erect, more closely pressed to and parallel with the stem: they are apparently narrower than those in *W. Pillansii* and reach up to the base of the spike, without the long internodes between them that *W. Pillansii* has, there being four leaves on the six inches length of stem below the lowest bract of the spike. The bracts are also more acute than those of *W. Pillansii.* Otherwise the specimen is like that species; I do not exactly match it with any specimen at Kew.

GALAXIA Thunb.

G. GRAMINEA Thunb. Nov. Gen. Pl. 51, with fig. (1782). Two sheets:—

- α. This is the same as the blue-flowered form of *Galaxia ovata* Thunb. It is not *G. graminea* Thunb.
- β. **Galaxia fugacissima** Druce. This is the plant actually figured by Thunberg as *G. graminea* and therefore must be taken as the type of this species. *Ixia fugacissima* Linn. f. (1781).

G. OVATA Thunb. Nov. Gen. Pl. pt. 1, p. 51, with fig. (1782).

Two sheets, of which that marked "*Galaxia ovata*: *lutea*" should be taken as the type of the species and as being **Galaxia ovata** Thunb. & Andrews, Bot. Rep. t. 94. *G. obtusa* Salisb. *Ixia galaxia* Linn. f. (1781).

The blue-flowered specimens on the other sheet, marked "*Galaxia ovata*: *cærulea*," belong to a different species and may possibly be **G. versicolor** Salisb. as named by Klatt.

As no type of *Ixia galaxia* Linn. f. and *Ixia fugacissima* exists in the Linnean Herbarium, they were doubtless (as in most other cases) described from specimens in Thunberg's Herbarium.

GLADIOLUS L.

G. ALATUS Thunb. Diss. Glad. 16 (1784).
One sheet=**G. alatus** L. (1760).

G. ALOPECUROIDES Thunb. Diss. Glad. 15 (1784). Three sheets:—

α is **Micranthus alopecuroides** Eckl. (*i.e.*, it agrees with *Ecklon* 9, so named by Ecklon), and matches the type of *Gladiolus alopecuroides* L. (1756). It is not *M. plantagineus*, as named by Klatt.

β is **Micranthus plantagineus** Eckl., not *M. fistulosus*, as named by Klatt.

The third sheet is not lettered and contains leaves only, which belong to **Micranthus fistulosus** Eckl.

G. ANCEPS Thunb. Diss. Glad. 17, t. 2 (1784). One sheet.

Two very distinct species have been confused by Baker under this name, of which the following is the true synonymy:—

In the Linnean Herbarium there are three sheets named *Gladiolus anceps* by Linn. f. Of these, sheet 19, bearing Sparrmann's number 112, contains the only specimen that agrees with the description in having undulated or crisped edges to the leaves and stem, and therefore must be accepted as the type; it is identical with the type-specimen of *G. anceps* Thunb. The other two specimens in the Linnean Herbarium belong to **Lapeyrousia Fabricii.** Therefore *G. anceps* Linn. f. and of Thunberg is:—

Lapeyrousia anceps Baker, Hand. Irid. 172 (1892), as to description and including var. *aculeata*, not of Ker! *Gladiolus anceps* Linn. f. Suppl. 94 (1781), and Thunb. Diss. Glad 17, t. 2 (1781). *Gladiolus denticulatus* Lam. Encycl. ii, 728 (1786). *Oveida anceps* Spreng. Syst. i, 147 (1825). *Lapeyrousia aculeata* Sweet, Hort. Brit. ed. 1, 396 (1827). *Peyrousia aculeata* Sweet, Brit. Fl. Gard. ser. 2, t. 39 (1828). *Lapeyrousia serrulata* Schlechter in Journ. of Bot. 1897, 432.

This is the plant with two-edged stems more or less denticulate along the edges, crisped edges to the leaves, and long-tubed pale lilac-tinted flowers with purple spots on the lower segments. The following specimens are typical:—*MacOwan*, Herb. Austr. Afr. 1972, from Pakhuis Mountain in Clanwilliam Division! Piquetberg, *Drége*! and *Zeyher* 1617, without precise locality, and including all those quoted by Baker in Fl. Cap. vi, 94, except that of *Burchell.*

Probably *Lapeyrousia compressa* Pourret in Mém. Acad. Toul. iii, 80, t. 6 (1788), is only a form of this species with short-tubed flowers. Pourret's figure agrees with *L. anceps* as to the stem, leaves, and bracts, but he figures the tube of the perianth as being only about one inch (instead of 1½–2½ inches) long, and describes the tube as "generally the length of the outer bracts," and the flowers as pale blue or bluish white, marked with longitudinal lines of darker blue that do not extend to the edges of the segments. He states that it was sent from Mauritius by Commerson.

The plant which Ker named *Lapeyrousia anceps* is quite distinct from the above, and was founded upon *Gladiolus anceps* Jacq., not of Linn. f. As it has not been otherwise named, I propose the following name for it :—

Lapeyrousia Jacquinii N. E. Brit., nom. nov. *L. anceps* Ker in Konig & Sims, Ann. i. t. 238 (1804) ; Sweet, Brit. Fl. Gard. ser. 1, t. 143 (1838). *Gladiolus anceps* Jacq. Coll. iv, 163 (1790), and Ic. Rar. t. 269, not of Thunberg, as Jacquin wrongly supposed it to be.

This species differs from *L. anceps* by the edges of its stem being usually without teeth, leaves not or but slightly crisped at the edges, and the flowers very much smaller and of a dark purple or violet-purple colour, with segments less than half an inch long. The following specimens belong to it:—*MacOwan* 2469, from Lion Mountain ! ; *Schlechter* 8340, from Wind Hoek !; *Stephens* 7093, from near Warm Bath, at the foot of Oliphants River Mountains ! ; the specimen collected by *Burchell,* quoted under *L. anceps* by Baker ! This specimen bears no number or other indication of locality and is probably from plants cultivated by Burchell, since it is labelled "*Lapeyrousia*—Bot. Mag."

G. ANGUSTUS Thunb. Diss. Glad. 19 (1784). One sheet.

This is **Gladiolus vinulus** Klatt=*MacOwan,* Herb. Norm. 287 ! It is not *G. angustus* L. nor *G. fasciatus* Roem. & Schult., as named by Klatt.

G. BICOLOR Thunb. Diss. Glad. 16, t. 2 (1784). Two sheets.

Both sheets contain specimens of **Synnotia bicolor** Sweet.

G. BRACTEATUS Thunb. Prodr. 186 (1800), and in Naturhist. Selsk. Köbenh. 1810, 12, t. 3. Two sheets.

Both are **Laypeyrousia fissifolia** Ker.

G. BREVIFOLIUS Thunb. Prodr. 184 (1800). Two sheets.

Both appear to be **G. brevifolius** Jacq. (1790).

G. BULLATUS Thunb. MS. in Herb. (not in Diss. Glad. 12 (1784), as quoted by Prof. Juel). One sheet.

This is **G. spathaceus** Pappe !, not *G. inflatus* Thunb. as named by Klatt.

G. COMMUNIS Thunb. Diss. Glad. 13 (1784). One sheet marked *β*. This is **G. segetum** Ker, and the locality "*e Cap. b. spei*" is probably wrong.

G. CORDATUS Thunb. Prodr. 185 (1800). One sheet.

This is not *G. angustus* L. as named by Klatt and by Baker. Nor is it *G. trimaculatus* Lam., which is not the same as *G. angustus* L., under which species Baker has placed it. I do not match Thunberg's plant with any specimen in the Kew Herbarium, and therefore retain Thunberg's name. The following is a brief description of it:—

G. cordatus Thunb. Plant 8–14 inches high, glabrous. Leaves 3–4 to a stem, the lower 9–14 inches long, 1¼–2½ lines broad, overtopping the flowers, the others gradually smaller, linear, acute, somewhat thin. Stem simple, 1–5-flowered, very zigzag on the flowering part. Flowers 8–9 lines apart. Bracts 15–22 lines long, very acute, apparently purplish. Perianth-tube 15–16 lines long and exserted 5–6 lines beyond the bracts, slightly curved; segments 14–15 lines long, 4–5 lines broad, oblong-lanceolate, subacute, pinkish white, the lower having an obcordate mark (with the notch directed towards the apex of the segments) outlined apparently in purple or some dark red colour.

South Africa, without precise locality, *Thunberg*!

G. CRISPUS Thunb. Diss. Glad. 10, t. 1 (1784). One sheet.

This is **Tritonia crispa** Ker, and agrees with the type of *Gladiolus crispus* Linn. f. (1781).

G. DICHOTOMUS Thunb. Diss. Glad. 10 (1784). One sheet.

This is not *Gladiolus permeabilis* De la Roche, as Baker states, but is **Romulea dichotoma** Baker!

G. ELONGATUS Thunb. Prodr. 185 (1800). One sheet.

This is not at all like *G. gracilis* Jacq., under which Baker has placed it, nor yet like *G. strictus* (*hyalinus*) Jacq., as Klatt has named it upon the sheet. I do not find any specimen that agrees with it in the Kew Herbarium. It is evidently nearly allied to *G. permeabilis* De la Roche, but differs by its leaves being more terete, with the lower as long as or overtopping the flower-spike. The flowers are stated by Thunberg to be greenish, and one still seems to have a dingy green tinge upon it. The flowers, however, including the tube, are 9–11 lines long, not half an inch long as Thunberg states, unless he meant the segments only, not including the tube. The name **G. elongatus** Thunb. must therefore be retained.

South Africa, without precise locality, *Thunberg*!

G. EQUITANS Thunb. Prodr. 186 (1800), and in Naturhist. Selsk. Köbenh. 1810, 11, t. 2. One sheet.

This is **G. equitans** Thunb. (1800). *G. namaquensis* Ker (1802). It is perfectly distinct from *G. alatus* L.

G. EXSCAPUS Thunb. Prodr. 184 (1800), and in Naturhist. Selsk. Köbenh. 1810, 3, t. 1. Two sheets, both containing the same plant.

This is **Acidanthera exscapa** Baker (1876), not *A. tubulosa* Baker, which was founded upon *Ixia tubulosa* Houttuyn, 'Handleiding,' xii. 36, t. 78. fig. 2, and has smaller flowers than *A. exscapa*, with the perianth-segments about 9 lines long and stated to be rosy, tinted with red, and the tube scarcely longer than the bracts. *A. exscapa* has the perianth-segments 12–15 lines long and apparently white or pinkish, and the tube much (often an inch) longer than the bracts.

G. FABRICII Thunb. Prodr. 186 (1800). One sheet.

This is **Lapeyrousia Fabricii** Ker.

G. FALCATUS Thunb. Diss. Glad. 10, t. 1 (1784). One sheet.

This is **Lapeyrousia falcata** Ker in Konig & Sims, Ann. Bot. i, 238 (1804, not 1805 as stated in 'Index Kewensis'), *Gladiolus falcatus* Linn. f. It is identical with *Lapeyrousia Pappei* Baker (1892) !, which must now rank as a synonym. Both the names *G. falcatus* and *L. falcata* are omitted by Baker from his 'Handbook of the Irideæ' and the 'Flora Capensis.' Thunberg's specimen must be accepted as the type of this species, as there is no specimen of this single falcate-leaved plant collected by Thunberg in the Linnean Herbarium, but a specimen exists there of the many- and straight-leaved *Lapeyrousia juncea*, wrongly named "*G. falcatus*."

G. FLEXUOSUS Thunb. Diss. Glad. 9, t. 1 (1784). One sheet.

It is identical with the type of *G. flexuosus* Linn. f., and equals **Acidanthera flexuosa** Baker. As the perianth is irregular, I do not understand why it is not a true *Gladiolus*. There is no specimen like it in the Kew Herbarium.

G. GLUMACEUS Thunb. Prodr. 186 (1800). One sheet.

This equals **Watsonia marginata** Ker, according to Baker, and may be that species, but it is not *W. iridifolia* Sweet, as named by Klatt.

G. GRACILIS Thunb. Prodr. 185 (1800). One sheet.

This is **G. gracilis** Jacq. (1790).

G. GRAMINEUS Thunb. Diss. Glad. 22 (1784). Two sheets, both **Melasphærula graminea** Ker. Thunberg's specimens agree with the type of *Gladiolus gramineus* Linn. f. (1781).

G. GRANDIS Thunb. Prodr. 185 (1800). One sheet, the type of the species **G. grandis** Thunb.

G. HASTATUS Thunb. Prodr. 185 (1800). One sheet.

This is not at all like the plant with which it has been incorrectly identified by Baker and described by him as *G. hastatus*, but is a distinct species which I cannot match with any specimen in the Kew Herbarium. It is much like *G. inflatus* Thunb. (not of Baker), but differs in having the lower middle segment marked with a hastate (yellow ?) spot outlined with dark red or purple. Thunberg's specimen is the type of **G. hastatus** Thunb. *G. hastata* Baker in Fl. Cap. vi, 140, is entirely different, and is a mixture of at least three species, according to the Kew material.

G. INFLATUS Thunb. Prodr. 185 (1800). Two sheets, both **G. inflatus** Thunb., synonym *G. Bolusii* Baker (1892)! Upon comparing Thunberg's type with the Kew material, I find that Baker has misidentified it with a different species incorrectly described as *G. inflatus* in his 'Handbook of the Irideæ' and in the 'Flora Capensis.' The real *G. inflatus* he described as a new species under the name of *G. Bolusii*. Therefore the nomenclature of this species should stand as given above. I think that probably *G. Taubertianus* Schlechter (1900) also should be added as a synonym of *G. inflatus* Thunb., as it appears to be the same species but with rather smaller bracts. The above names refer to plants collected near Tulbagh and in the Cold Bokkeveld. Specimens collected on Genadendal Mountain in Caledon Division (*Galpin* 4719) look very similar to *G. inflatus*, but as the locality is so very different, and as Thunberg makes no mention of a "white diamond-shaped blotch with a brown border" on the three lower segments of the flower, stated to be present on Galpin's plant, I very much doubt if it is the same species. It may possibly belong to *G. Rogersii* Baker, mentioned below.

For the plant described by Baker as *G. inflatus* (excluding Thunberg's specimen and *G. bullatus* Thunb., quoted as a synonym) the name **G. ornatus** Klatt may be taken. It is identical with some specimens wrongly placed under *G. hastatus* Thunb. by Baker, but whether it is identical with *G. Thunbergii* Eckl. (placed as a synonym of *G. hastatus* by Baker) I am unable to say, as there is no typical specimen of that species at Kew. If it is, then the latter name, being the older, should be chosen.

Is the plant from the summit of Table Mountain which Baker has described as *G. Pappei* specifically distinct from *G. ornatus* Klatt, or is it only a mountain-form of that species with broader leaves than the type? *Bolus* 3883 belongs to it.

Included under *G. inflatus* Baker in Fl. Cap. vi, 147 (which, as above stated, must now be called **G. ornatus** Klatt) is a very distinct species from Swellendam, Knysna, and Riversdale Divisions, which is identical with **G. Rogersii** Baker and with the plant wrongly identified and described by Baker as *G. involutus* De la Roche. Mrs. Bolus has named it *G. Bolusii* var. *Burchelli* L. Bolus in Ann. Bolus Herb. ii, 101. It appears to me, however, to be totally different from *G. inflatus* Thunb. (*G. Bolusii* Baker) in its bracts and flowers. It should therefore take the name **G. Rogersii** Baker with synonyms *G. involutus* Baker in Fl. Cap. vi, 147, not of De la Roche; *G. Bolusii* var. *Burchellii* L. Bolus in Ann. Bolus Herb. ii, 101. As it has already been fully described, a further description is unnecessary. The following specimens belong to it:—

KNYSNA DIVISION: Groene Vallei, *Burchell* 5631 (the type of *G. Bolusii* var. *Burchellii* L. Bolus!). Woodlands, *Galpin* 4720! SWELLENDAM DIVISION: Tradouw Mountains, *Drège*! near Voormans Bosch and Grootvaders Bosch, *Zeyher* 3984! RIVERSDALE DIVISION: Albertinia, *Muir*! GEORGE DIVISION: near George, *Prior*! The locality "Cape Flats" for the type of *G. Rogersii* is possibly an error; it was collected in 1859 by the Rev. W. Moyle Rogers.

G. IXIOIDES Thunb. Fl. Cap. 208 (1811). One sheet.
This is **Ixia paniculata** De la Roche.

G. JUNCEUS Thunb. Diss. Glad. 18 (1784). One sheet.
This is **Lapeyrousia juncea** Pourr. = *Gladiolus junceus* Linn. f. (1781). Thunberg's specimen is the type of this species, as there is no specimen of it so named in the Linnean Herbarium. There exists, however, a specimen in the Smith Herbarium sent by Thunberg in 1791, bearing the name "*Gladiolus junceus*" in Thunberg's handwriting. This is a species of *Morea* and identical with *M. polyanthos* sheet *β* of Thunberg's Herbarium. There is also a specimen of the real *G. junceus* sent by Thunberg at the same time bearing the name "*Morœa polyanthus*," so that evidently the labels of these two specimens have been accidentally transposed.

G. LACCATUS Thunb. Prodr. 186 (1800). One sheet, the type of **G. laccatus** Thunb., synonym *G. villosus* Ker (1827). Both Ker and Baker cite *G. puniceus* Lam. (1786) as a synonym of this, but from Lamarck's description, which does not mention any pubescence, it does not appear to be the same species. Should it prove to be so, Lamarck's name must take precedence.

G. LÆVIS Thunb. Prodr. 184 (1800). One sheet.
This is **G. tenellus** Jacq., and not *G. gracilis* Jacq., under which Baker places it. The two species are easily distinguished. *G. tenellus* has the lower leaf overtopping the flower-spike and the flowers are light yellow with a purplish mid-line on the back of the segments. *G. gracilis* has the lower leaf shorter than the flower-spike and pale blue flowers.

G. LAXUS Thunb. Fl. Cap. ed. Schultes, 50 (1823). One sheet.
This is only a weak specimen of *Lapeyrousia cruenta* Baker, but, as Thunberg's specific name is much the older, I propose to restore it and call the species **Lapeyrousia laxa** N. E. Br., comb. nov. Synonyms—*Gladiolus laxus* Thunb. (1823); *Meristostigma laxum* A. Dietr. (1833); *Anomatheca cruenta* Lindl. (1830); *Lapeyrousia cruenta* Baker (1892).

G. LONGIFLORUS Thunb. Diss. Glad. 19 (1784). Two sheets. Both are the same plant and equal *G. longiflorus* Linn. f. (1781). As there is no specimen collected by Thunberg so named in the Linnean Herbarium, Thunberg's specimens must be considered as the type. There are, however, specimens collected by Sparrman in the Linnean Herbarium bearing the name *Gladiolus longiflorus,* which belong to the genus *Acidanthera,* and are identical with a specimen at Kew without a number, collected by Zeyher at Kuils River. This last is either a small-flowered form of *Acidanthera exscapa* Baker or a new species allied to it, and cannot in any sense be considered as representing the type of *Gladiolus longiflorus* Linn. f.

Thunberg's specimens of *Gladiolus longiflorus* belong to the genus **Tritonia,** and, as *Tritonia longiflora* Ker belongs to the genus **Ixia,** there is no reason why the Linnean and Thunbergian specific name should not be conserved under *Tritonia.* I therefore propose for it the name **Tritonia longiflora** N. E. Br., comb. nov. I fail to match this plant with any specimen at Kew. The name "*Montbretia striata* Baker" is written on the sheets by Baker, but that name is a synonym of *Tritonia Bakeri* Klatt, both names being founded upon a plant in the British Museum Herbarium collected by Oldenburg and Masson named "*Gladiolus striatus*" by Solander in MS. It is a different species from *G. longiflorus* Thunb., and differs from Zeyher 4017, which Baker quotes as belonging to it. As Baker's description of *Tritonia Bakeri* seems to have been made partly from Thunberg's and partly from Zeyher's specimen, the following particulars of the type (Oldenburg's specimen) may be useful :—

Tritonia Bakeri Klatt (*Montbretia striata* Baker; *Gladiolus striatus* Solander MS.). Leaves overtopping the flowers, involutely terete and about ⅔ line thick, acute, conspicuously and rather deeply striate. Stem simple or with one branch. Flowers 4–5 to a spike, 5–9 lines apart. Bracts 4–4½ lines long, oblong-ovate, obtuse, and often minutely 3-toothed at the apex, membranous, brown, with seven or more veins conspicuous to the base (this is not the case in Zeyher's 4017 and well distinguishes it from that species). Corolla 1¾–2 inches long with the slender part of the tube 10–12 lines long ; lobes oblong. obtuse, apparently whitish or of a pale lavender tint with darker veins.

South Africa : without precise locality, *Oldenburg* ! *Masson* !

T. Bakeri differs from *T. longiflora* N. E. Br. in the leaves overtopping the flower-stem (in *T. longiflora* they are much shorter than it) and in being involute-terete, more slender and conspicuously striate, and in the flowers being fewer to a spike and farther apart.

G. MARGINATUS Thunb. Diss. Glad. 18 (1784). Five sheets, each containing a different species, none being the same as *Gladiolus marginatus* Linn. f. :—

a. This is named "*Watsonia Pillansii* L. Bolus" by Mrs. Bolus, but it does not agree with either of the specimens that have been so named by Mrs. Bolus at Kew, and that seem to me to comprise two distinct species. Thunberg's specimen is probably the same as Schlechter 7349, from Houw Hoek, which is named at

Kew and described by Mrs. Bolus as **Watsonia Schlechteri** L. Bolus.

β is **Watsonia Ardernei** Sander.
γ is **Watsonia Meriana** Miller.
δ is **Watsonia brevifolia** Ker.
ϵ is **Watsonia humilis** Miller.

G. MERIANELLUS Thunb. Diss. Glad. 14 (1784). One sheet. This is **Antholyza merianella** L.

G. MERIANUS Thunb. Diss. Glad. 14 (1784). Two sheets. Both are **Watsonia aletroides** Ker.

G. MONTANUS Thunb. Diss. Glad. 9, t. 1 (1784). One sheet, equals *G. montanus* Linn. f. (1781).

Incredible confusion has been made over this plant both by Baker and Klatt. I have compared the Kew material with the Linnean, Thunbergian, and other available types, and give as the synonymy :—

Gladiolus parviflorus Jacq. Obs. iv, 2, t. 78 (1771).

Gladiolus montanus Linn. f. Suppl. 95 (1781), Thunb. Diss. Glad. 9, t. 1, and of Baker in Journ. Linn. Soc. xvi, 178 (excluding syn. *Schweiggera nemorosa* E. Mey. (1877)), but not as to description and specimens quoted in Fl. Cap. vi, 163.
Gladiolus arenarius Baker in Journ. Linn. Soc. xvi, 178 (1877), and in Fl. Cap. vi, 163 (1896).
Hebea orchidiflora Eckl. and *H. tabularis* Eckl. Top. Verz. 43 (1827).
Antholyza montana Klatt in Linnæa, xxxii, 732, and *A. orchidiflora* Klatt, *l. c.* 733 (1863).
Antholyza fragrans E. Meyer ex Klatt, Erganz. 13 (1882).

Typical examples of this plant are :—CAPE DIVISION : Cape Flats, *Ecklon* 10 !, *Wolley Dod* 484 !, *Bolus* 3837 ! Muizenberg Hills, *Moss* 8145 ! Locality doubtful, *Zeyher* 1612 !

Under *G. arenarius*, Baker included a similar, yet distinct and easily recognized, species, which seems to be undescribed, although not uncommon on Table Mountain. I propose for it the name :—

G. fraternus N. E. Br., sp. nov., *G. parvifloro* Jacq. similis, sed perianthio 6–7 (nec 8–9) lin. longo, lobis subæqualibus integris apice subtruncatim rotundatis et æquabiliter luteis differt.

G. fraternus N. E. Br. Habit, leaves, and flower-spike very like those of *G. parviflorus* Jacq., but the perianth is only 6–7 (instead of 8–9) lines long, its segments are all subequal in length, are not notched at the subtruncately rounded apex, and all apparently uniformly yellow in colour, not purple on the basal half of the lower segments.

CAPE DIVISION : Table Mountain, *Burchell* 640, the type! Other specimens are :—*Drège* 8342 ! ; *Moss* 8601 ! ; sides of mountains near Kalk Bay, *Bolus* 4002 ! ; *Wolley Dod* 670 ! ; Plateau near Muirzenberg, *Moss* 4181 !.

The plant which Baker has described (Fl. Cap. vi, 163) as *G. montanus* is a mixture of two, if not three, distinct species, of which the following appears to be the synonymy :—

Gladiolus ramosus N. E. Br., comb. nov.

Hebea ramosa Eckl. Top. Verz. 43 (1827).
Antholyza ramosa Klatt in Linnæa, xxxii, 734 (1863).
Gladiolus montanus var. *ramosus* Baker in Journ. Linn. Soc. xvi. 178 (1877), and in Fl. Cap. vi, 164.

CALEDON DIVISION : Mountains near Grietjesgat, *Ecklon* and *Zeyher* ! : Caledon, *Prior* ! ; Ganze Kraal on the Alang River, *Burchell* 7559 ! ; between Donker Hoek and Houw Hoek, *Burchell* 8012 ! ; Bavians Kloof, *Burchell* 7602 !.

This species usually has a rather slender branched inflorescence and narrow leaves, 2–2½ lines in breadth. The flowers appear to have been more or less pinkish or purplish.

Closely allied to *G. ramosus* N. E. Br. is a plant which Baker described as *Tritonia unguiculata*, for which I propose the name :—

Gladiolus unguiculatus N. E. Br., comb. nov.

Tritonia unguiculata Baker, Handb. Irid. 196 (1892) and Fl. Cap. vi, 128.

This differs from *G. ramosus* by its corm being smaller, 5–6 lines in diameter, and without an outer dense coating of long black fibres, such as is present in *G. ramosus* ; by the branches of the flowering stems being nearly erect or very ascending, and only 9–10 lines long below the flowers, while in *G. ramosus* they are 1–3 inches long below the flowers : the perianth is 15 lines long, with a tube 6 lines long while in *G. ramosus* it is only 12 lines long, with a tube 4½–5 lines long. Otherwise the two species are very similar.

South Africa, without precise locality, *Kitching*, the type !. A specimen collected on the Postberg in George Division, *Burchell* 5949, appears to belong to this species.

Gladiolus nemorosus N. E. Br., comb. nov.

Schweggera nemorosa E. Mey. Docum. 109, 110 (1843).
Antholyza nemorosa Klatt, Erganz. 12 (1882).
Gladiolus montanus var. *nemorosus* Baker in Fl. Cap. vi, 164 (1896).

CLANWILLIAM DIVISION : between Lange Vallei and Oliphant's River. *Drège* ! ; slopes above Kradouw Krantz, *Pearson* 5305 !.

This is characterized by its leaves being 5–7·5 lines broad, its stout simple or sparingly branched inflorescence, and yellow flowers, with some of the segments purplish at the tips and the lower with a purple mid-line.

Besides the above, Baker and other authors have included under *G. montanus* L. at least four other species with unbranched flowering stems, some with broad and others with narrow leaves. These have not yet been properly dissected and compared.

G. PLICATUS Thunb. Diss. Glad. 20 (1784). Seven sheets :—

α is **Babiana stricta** Ker, ex Baker. It is not *B. villosa* Ker.

β is **Babiana** sp. (*Zeyher* 4001) placed under *B. stricta* Ker by Baker, but as defined by him *B. stricta* is a mixture of several species.

γ is **Babiana disticha** Ker. It is not *B. villosa* Ker as named by Klatt.

δ contains two different species of *Babiana*, neither being *B. villosa* as named by Klatt. The left-hand specimen is the same as a specimen at Kew from Lion Mountain, named "*B. cœrulescens*" by someone, and by Baker called *B. plicata* Ker. The right-hand specimen is the same as *Drège* 8384, named *B. plicata* by Baker.

ε is a species of **Babiana**, which I could not match at Kew ; it is not *B. villosa* Ker as named by Klatt.

ζ. I do not match with any species of *Babiana* at Kew ; it is not *B. mucronata* Ker, as named by Klatt.

η is **Babiana plicata** Ker, not *B. sulphurea* Ker, as named by Klatt.

G. PUNCTATUS Thunb. Prodr. 185 (1800). One sheet.

This is **G. punctatus** Thunb., but not of Jacquin. I do not match it with any specimen at Kew. It is not *G. carneus* De la Roche, as named by Klatt.

G. RECURVUS Thunb. Diss. Glad. 9 (1784). Two sheets, each containing a different species :—

α. The specimens on this sheet have 3 flowers to a plant, and appear to be those which Thunberg described, as the specimens on sheet β do not conform so well to his description, having 8–9 flowers on each specimen and a totally different corm. I consider that sheet α must be taken as the type of *G. recurvus* Thunb., a totally different plant from *G. recurvus* L. As it belongs to a different genus from the Linnean plant the specific name may be retained for it.

I find this type of *G. recurvus* Thunb. to be identical with a species of *Hesperantha* collected at Camps Bay by Prior, now in Kew Herbarium. It may be only a young or weak few-flowered state of one of the species known as *H. radiata*, although dwarfer and with fewer flowers than the other specimens of that species that I have seen, but, whether it is or is not that species, Thunberg's specific name being much older, must take precedence. I therefore give the following description of the specimens seen, together with the synonymy that I think may belong to it, on the assumption that it is only a state of *H. radiata* Ker :—

Hesperantha recurva (by error "*recurvata*") Ascherson & Graebner, Synop. Mitteleurop. Fl. iii, 540 (1906).—Quite glabrous. Corm ·5 inch in diameter with dark brown imbricating tunics that are not broken up into segments, but bear several sharp keels at intervals of about 1 line apart; the basal margin is truncate and broken up all around into a fringe of very short fibres. Leaves 3 to a stem, ¾–1·5 inch long, ¾–1 line broad, ascending-spreading, linear, acute. Stem 5–8 inches high, bearing only 2–3 flowers about 6–9 lines apart. Bracts 5–6 lines long, shortly acute, striate, purplish. Flowers all directed to one side; tube 5–6 lines long and about 1¼ line longer than the bracts, slender, decurved at the apex: segments reflexed, 5–6 lines long, 1·5 line broad, lanceolate, acute, the outer brownish on the back, the inner white. Stamens with filaments 2·5 lines long and anthers 2·5 lines long (in Prior's specimen the anthers are about 3 lines long).

Gladiolus recurvus Thunb. Diss. Glad. 9 (1784), not of Linné.

If this proves to be merely a few-flowered form of *H. radiata* Ker, then the following synonyms should be added :—*Ixia radiata* Jacq. Collect. v, 15 (1796), and Ic. Rar. t. 280; Bot. Mag. t. 573. *Ixia fistulosa* Andr. Bot. Rep. t. 59, not of Ker.

Hesperantha radiata Ker (1804). Excluding the reference to *Ixia recurva* Vahl, as given by Baker and Ascherson & Graebner.

This plant is not at all like *Hesperantha graminifolia* Sweet, as it has been named by Klatt.

CAPE DIVISION : Camps Bay, *Prior*!, without precise locality, *Thunberg*!.

β is **Hesperantha setacea** Eckl., and is quite distinct from *H. radiata* Ker, as named by Klatt, and under which Baker places it as a variety, differing in its corm, size, leaves, and flowers.

G. RINGENS Thunb. Prodr. 186 (1800). Five sheets, each containing a different species of **Babiana** :—

α is *MacOwan*, Herb. Norm. Austr. Afr. 273, placed under **Babiana plicata** Ker by Baker. It is not *B. nana* Spreng. as named by Klatt.

β is *Zeyher* 1616, **Babiana** sp. It is not *B. obtusifolia* as named by Klatt.

γ. This sheet appears to contain two different species, neither of them *Babiana sambucina* Ker, as named by Klatt. The right-hand specimen I fail to match at Kew. The left-hand specimen is the same as a specimen at Kew from Riebeks Kasteel, without number or name of collector.

δ. This sheet also contains two very distinct species, neither of them *Babiana reflexa* Eckl. as named by Klatt. The right-hand specimen agrees with a specimen at Kew, collected by Dr. Thom near Tulbagh. The left-hand specimen is **Babiana disticha** Ker.

ε is a very distinct species of **Babiana** that I cannot match with any specimen at Kew. It is not *B. mucronata* as named by Klatt.

G. SECUNDUS Thunb. Prodr. 186 (1800), and in Naturhist. Selsk. Köbenh. 1810, 14, t. 4. One sheet.

This is **Babiana secunda** Ker. Syn. *B. reflexa* Eckl., which latter is not a variety of *B. stricta* as Baker states.

G. SETIFOLIUS Thunb. Diss. Glad. 18 (1784). One sheet.

This plant was earlier described by the younger Linné under the same name, and, as there is no specimen of it so named in the Linnean Herbarium, Thunberg's specimen is the type of the species. Baker has placed it as a synonym of *Lapeyrousia divaricata* Baker, but, as there is no reason whatever for the suppression of the Linnean name, I propose to restore it and call the plant **Lapeyrousia setifolia**, N. E. Br., comb. nov. Syn. *Gladiolus setifolius* Linn. f. Suppl. 96 (1781); *Lapeyrousia divaricata* Baker in Journ. Bot. 1876, 337. The plant is not *Anomatheca juncea* as named by Klatt.

G. SPARRMANNI Thunb. in Vet.-Akad. Handl. 1814, 189, t. 9 A. Two sheets :—

α is **Freesia Sparrmanni** N. E. Br. in Flowering Pl. of S. Afr. i, under t. 11 (1921). It is not *F. refracta* as named by Klatt and by Baker.

β is possibly a variety of the plant known in gardens as **Freesia refracta** var. **alba**, with the segments purple on the back, but it is not typical *F. refracta* Klatt as named by Klatt, as the tube of the perianth is more than twice as long as it is in that species.

G. SPATHACEUS Thunb. Diss. Glad. 22 (1784). One sheet.

This is **Babiana spathacea** Ker, and must be taken as the type of *Gladiolus spathaceus* Linn. f. (1781), as there is no specimen of it in the Linnean Herbarium. In the Smithian Herbarium, however, there is a specimen of it received from Thunberg in 1791. It is not *B. tubiflora* as named by Klatt.

G. SPECIOSUS Thunb. Fl. Cap. ed. Schultes, 48 (1823). One sheet.

This name must be retained for this plant, for it is not *G. alatus* L. as named by Klatt and under which Baker has placed it as a synonym, for it differs from that species in the venation of its leaves. Its flowers are similar to those of *G. alatus*, but it is a much more dwarfed plant, being only 5 inches high, with two linear curved leaves, respectively 7½ and

2½ inches long and 1½ line wide, with venation similar to that of *G. arcuatus* Klatt, and not at all like that of *G. alatus*. I cannot match Thunberg's plant with any specimen at Kew.

This species is omitted from Prof. Juel's 'Plantæ Thunbergianæ.'

G. SPICATUS Thunb. Diss. Glad. 15 (1784). One sheet. A species of **Watsonia.**

This is considered by Baker and Klatt to be *Watsonia punctata* Ker, but it seems to differ in having flat leaves.

G. SPIRALIS Thunb. Herb. Two sheets:—

α contains one specimen of **Watsonia brevifolia** Ker and two specimens of **Watsonia humilis** Miller.

β is **Watsonia roseo-alba** Ker, according to Mrs. L. Bolus, who is monographing this genus. It is not *W. humilis* as named by Baker nor *W. brevifolia* as named by Klatt.

G. TENELLUS Thunb. Prodr. 185 (1800). Two sheets:—

α is, I think, **G. tenellus** Jacq., not *G. trichonemifolius* Ker as named by Klatt, as the petals are not acuminate as in that species. It is also totally different from the plant Baker has placed under the name *G. tenellus* in Fl. Cap. vi, 141.

β is **G. trichonemifolius** Ker.

The plant from Devil's Peak and Table Mountain (*Bolus* 4890, *Dummer* 7, *Wilms* 3695, &c.), placed by Baker and South African botanists under *G. tenellus* and sometimes also named *G. hyalinus*, is a totally different species from *G. tenellus* Jacq. This latter has a different corm, pale yellow flowers without dots, and with a dull purple line on the back of the obtuse segments, which are 2½–3½ lines broad. According to Bolus, the Devil's Peak plant has flowers that are "greenish with a little purple," though the dried flowers appear to have been greenish yellow with a dark purple median line having several dots on each side of it at the basal part of the lower segments. The segments are acute and the dorsal one is 5–6 lines broad. For this plant I propose the name:—

G. confusus N. E. Br., sp. n. Planta 12–18 poll. alta. Cormi tunicæ basi segmentibus unguiformibus divisæ. Folia compresso-teretia. ½–¾ lin. crassa, utrinque sulcata. Spica sæpe 1–3- (interdum ad 6-) flora. Bracteæ erectæ, 12–18 lin. longæ, acutæ. Perianthii tubus 12–14 lin. longus, lobi 9–11 lin. longi, dorsali 5–6 lin. lato elliptico-ovato acuto, reliquis 2½–3½ lin. latis lanceolatis acutis vel acuminatis viridi-luteis cum lineis brunneo-rubris notatis.

Plant 12–18 inches high, quite glabrous. Corm 6–10 lines in diameter, dark brown, its overlapping coats with their lower halves divided into numerous claw-like segments ¾ line broad. Leaves two to three to a stem, the lower one free of the sheath below the middle of the stem and overtopping the flower-spike ½–¾ line thick, compressed-terete, with two grooves on each face, acute, the others very much shorter. Stem unbranched, ¾–1 line thick, terete, usually 1- to 3-flowered, but one of Thunberg's specimens (under *G. tristis*) is 6-flowered. Flowers 10–18 lines apart. Bracts very erect, 12–18 lines long, green, acute. Perianth ascending or, from the curvature of the tube, sub-horizontally spreading; tube about 12–14 lines long, curved; segments 9–11 lines long, the dorsal segment 5–6 lines broad, elliptic-ovate, acute, and the others 2½–3½ lines broad, lanceolate, two of them acute, the other three acuminate. According to Bolus and Wolley Dod in Trans. S. Afr. Phil. Soc. xiv, 334, this plant has "dark brown flowers inclining to purplish, but, translucent and very rigid"; but, according to the coloured illustration of it in 'Protected Wild Flowers' of South Africa, the ground-colour of the three upper segments is greenish yellow with a dark red mid-line and numerous lateral dark red streaks, and the three lower segments greenish with darker green or purplish-green mid-line and streaks, the spots at the base of the segments not being represented, although they are very evident in dried specimens.

The type of this species is *Bolus* 4890, from near Mowbray, in stony places at the foot of Devil's Peak, Cape Division.

G. TRINERVIS Thunb. in Mus. Nat. Upsal. Append. xxii, 27 (1814), name only. One sheet.

This is **G. parviflorus** Jacq. *G. montanus* Thunb. is the same plant, which see for synonymy.

G. TRISTIS Thunb. Prodr. 8 (1794). Five sheets, containing three species:—

α is a **Gladiolus** species, not matched at Kew.

β is **G. maculatus** Sweet.

γ, *δ*, and *ε* are **G. confusus** N. E. Br. *G. tenellus* Baker, not of Jacquin. See under *G. tenellus*.

G. TRITICEUS Thunb. Fl. Cap. 194 (1811). One sheet.

This is **Watsonia subulata** Klatt, Erganz. 19 (1882). Syn. *Gladiolus subulatus* Vahl, Enum. ii, 97 (1806); *G. triticeus* Thunb. (1811). *Watsonia punctata* var. *triticea* Baker.

G. TUBIFLORUS Thunb. Diss. Glad. 20, t. 2 (1784). One sheet.

This is **Babiana tubiflora** Ker, and must be considered as the type of *Gladiolus tubiflorus* Linn. f., which was described from a specimen collected by Thunberg, as there is no specimen bearing this name of Thunberg's collecting in the Linnean Herbarium. There are, however, in the Smith

Herbarium, three specimens collected by Sparrmann mounted on one sheet bearing the name *G. tubiflorus*, which represents three species, none of which is the same as *G. tubiflorus* Thunb. and cannot constitute the type of this species.

G. UNDULATUS Thunb. Prodr. 186 (1800). Four sheets :—

α is **G. cuspidatus** Jacq. (1796), not *G. Milleri* Ker as named by Klatt.

β is the same plant as *Zeyher* 1631, placed by Baker under *G. cuspidatus* Jacq., but I doubt if it is that species. It is not *G. angustus* Ker, as named by Klatt.

γ is **G. undulatus** Jacq. (1789).

δ is **G. cuspidatus** Jacq.

G. VIRESCENS Thunb. Fl. Cap. ed. i, 196 (1811). Two sheets :—

α is **G. virescens** Thunb. (1811). *G. bicolor* Baker (1877) !. The two specimens on the sheet both belong to one species, and neither of them is *G. formosus* Klatt nor *G. viperatus* Ker, as named by Klatt. It is distinct from *G. orchidiflorus* Andr., under which Baker has placed it as a synonym, being identical with the plant he describes under the name *G. bicolor*.

As it is evident that Thunberg's description of *G. virescens* was made from the specimens on sheet α, they must be taken as the type of the species and Thunberg's name retained.

β is **G. pulchellus** Klatt.

G. WATSONIUS Thunb. Diss. Glad. 14 (1784). Two sheets :—

α is **Antholyza revoluta** Burm.

β is **Watsonia spectabilis** Schinz.

IRIS L.

I. ANGUSTA Thunb. Diss. Iris, 19 (1782). One sheet.
Morea angusta Ker. The type of the species.

I. BIFLORA, sheet γ, marked as coming from "Cap. bona spei," is not a South African plant.

I. BITUMINOSA Thunb. Diss. Iris, 26, t. 2 (1782). One sheet.
This is **Morea bituminosa** Ker, and the type of the species, as there is no specimen of it in the Linnean Herbarium. I do not match this with any specimen at Kew ; the broad flat spirally twisted leaf and flower-clusters on

rather stout bent peduncles at each node distinguish this from all others. Thunberg's figure of his type is excellent.

I. CILIATA Thunb. Diss. Iris, 8 (1782). One sheet.

This is **Morea ciliata** Ker. As there is no specimen so named in the Linnean Herbarium, this must be taken as the type.

I. COMPRESSA Thunb. Diss. Iris, 12 (1782). Three sheets, all **Dietes vegeta** N. E. Br. (see under *Iris tristis*). *Moræa vegeta* L., Sp. Pl. ed. 2, 59 (1762) ; Miller, Dict. ed. 8, No. 1 (1768) ; *M. iridioides* L., Mantissa Sp. Pl. 28 (1767), excluding reference to Tilli, Cat. Pl. Pisani, and the locality Constantinople, which belongs to Tilli's plant. *Iris compressa* Linn. f. Suppl. 98 (1781), the type of this is in the Linnean Herbarium ; *Morea spatha uniflora, foliis gladiatis, radice fibrosa*, Miller, Figures of Plants, ii. 159, t. 239. f. 1 (1760).

Owing to the inadequate description of this plant given by Linné and his incomplete reference to its original place of publication (the entire description and reference being "Moræa foliis canaliculatis, Mill. Dict."), the name "*M. vegeta* Linn." has not previously been used for this plant.

In Linné's own copy of his 'Species Plantarum,' which is interleaved and annotated, evidently in preparation for a third edition of that work, I find that Linné has written in his own handwriting against *M. vegeta*, before the printed words "foliis canaliculatis," the words "spatha uniflora," and after them the word "gladiatis," and has added the words "Cap. B. Spei" and "Rd. fibrosa." These added words are evidently copied from Miller's description of "*Morea spatha uniflora, foliis gladiatis, radice fibrosa*," quoted above, and indicate that it was this plant he intended should bear the name *M. vegeta*, although he subsequently confused it with a plant from Constantinople, published by Tilli, and gave it the new name of *M. iridioides* (see also under *Iris tristis* Thunb.). Therefore, as I consider the genus *Dietes* to be quite distinct from *Morea*, I have restored Linné's earliest name to this plant in placing it under that genus.

The plant in the Linnean Herbarium that is named "*M. vegeta*" is not in the least like the plant Miller figures and describes, but is the same as *Iris plumaria* Thunb. (which see). As it is marked on the sheet as having been collected by Sparrmann, who was in South Africa only from April to November in 1772 and from March 1775 to April 1776, the specimen could not have been seen by Linné until at least ten years after he had published the name *Moræa vegeta*, and therefore cannot be taken as the type of that species, which unquestionably was founded entirely upon Miller's figure and description of it.

As I find that the genus *Dietes* has not been recognised since it was established by Salisbury as distinct from *Morea*, except by Klatt, I here give the characters that seem clearly to distingush *Morea* and *Dietes* ;—

MOREA Miller.

Root-stock a corm. Leaves flattened from above, or concave-channelled, or with inrolled edges or terete, never laterally flattened. Perianth-segments with an erect or ascending claw or basal part and a spreading or deflexed limb. Filaments of the stamens more or less united at the base into a tube enclosing the style. Style-arms with the part below the lobe cuneate or cuneately linear and usually more than twice as long as broad.

DIETES Salisbury.

Root-stock a stout creeping rhizome. Leaves laterally flattened, broadly linear or sword-shaped in side view, arranged into two ranks. Perianth-segments spreading from their base. Filaments of the stamens free. Style-arms with the part below the lobes elliptic, oblong, or cuneately oblong, not more and often less than twice as long as broad.

The known species of *Dietes* are as follows :—

* Flower 3–4¼ inches in diameter, white, with orange-yellow and brownish spots on the basal part of the petals and a transverse violet band on the style-arms; leaves erect, 2–4 ft. long, 5–9 lines broad .... **D. grandiflora**

** Flower 2–2½ inches in diameter, marked on the outer petals with a large central spot ; leaves erect or ascending, not spreading in fan-like manner.

  Flower yellow, with a large blackish-brown central spot on the outer petals: leaves 2–2½ ft. long, 2–3½ lines broad, but figured as broader.................................... **D. bicolor.**

  Flower white or white tinged with blue, with a yellow spot on the outer petals; leaves mostly ½–1½ (but sometimes up to 2½) ft. long, 3–5 lines broad .... **D. vegeta.**

*** Flower 1½ (? 2) inches in diameter, white, without a central spot on the outer petlas, which are bearded along the keel of the claw; leaves diverging in a fan-like manner.

  Flower-stem much longer than the leaves, 2–6 ft. long, becoming decumbent and often producing young plants at some of the nodes .... **D. prolongata.**

  Flower-stem not much longer than the leaves, 1–2 ft. long, erect, not producing young plants at the nodes .... **D. prolongata var. Galpini.**

D. grandiflora N. E. Br., sp. n. Folia 2–4 ped. longa, 4–8 lin. lata, erecta. Inflorescentia folia æquans vel superans. Perianthium 3½–4¼ poll. diametro, segmentibus albis basi luteo-brunneis notatis et exterioribus luteo-barbatis. Styli rami albi fascia violacea transversa notati.

Leaves 2–4 feet long, 4–8 lines broad, nearly erect, not spreading in fan-like manner. Flower-stem as long as or overtopping the leaves, erect, unbranched or 1–2 with branches at the upper part, each stem or branch with only one flower-cluster. Perianth 3½–4¼ inches in diameter, white, with a yellow-bearded keel on the outer segments, some yellowish-brown marks on the basal part of all the segments, and a transverse violet band at the base of the lobes of the style-arms.

KENTANI DIVISION : banks of streams, 1,200 ft., *Pegler* 484, the type!. NATAL : Groenberg, 2,000 ft., *Wood* 1099 !, and near Pinetown, 1,000 ft., *Wood* !.

D. bicolor Sweet, Hort. Brit. ed. 3, 661 (1839). Leaves 2–2½ ft. long, 2–3½ lines broad on wild specimens, but figured as being 6 lines or more broad on cultivated plants, apparently sub-erect, not spreading in fan-like manner. Flower-stem (only the flowering part seen) branching above and forming a lax and somewhat flat-topped cymose inflorescence 4–7 inches in diameter, with 4–10 flower-clusters. Perianth about 2 inches in diameter, yellow, with a large blackish central spot and a few reddish-brown dots below it on the outer segments, which are bearded along the claw. Style-arms about 7 lines long and 4 lines broad at the middle, ovate, bifid at the apex with diverging lobes.—Klatt in Linnæa, xxxiv, 584 (1866). *Iris bicolor* Lindl. Bot. Reg. t. 1404 (1831), Lodd. Bot. Cab. t. 1885 ; *Moræa bicolor* Spae in Ann. Soc. Roy. D'Agr. et Bot. Gand, 1846, 233, t. 70, and Fl. des Serres, 1852, 273, t. 714; Baker in Fl. Cap. vi. 26.

BATHURST DIVISION : among shrubs on the banks of the Kap River, near Kowie, *MacOwan* 2986 ! and Herb. Austr. Afr. 1538 !.

D. vegeta N. E. Br., comb. nov. Leaves ½–2½ ft. long, 3–5 lines broad, ascending and not very divergent. Flower-stem 1–2 ft. high, simple or branched. Perianth 2–2½ inches in diameter, white or white with a bluish tinge, with a large roundish yellow central spot on the outer petals, which are distinctly bearded along the keel of the claw and are without (or with?) a row of small wart-spots on each side of the keel. Style-arms about 3½–4 lines long and 2 lines broad below the stigma.—*Moræa vegeta* L., Sp. Pl. ed. 2, 59 (1762) ; *M. iridioides* L., Mantissa, 28 (1767) ; *M. catenulata* Lindl. Bot. Reg. t. 1074 (1827) ; *M. iridioides* var. *catenulata* Baker, Handb. Irid. 60 ; *Iris compressa* Linn. f. Suppl. 98 (1781). *I. moræoides* Lodd. Bot. Cab. t. 1428 (1828) ; *I. crassifolia* Lodd. Bot. Cab. t. 1861 (1832). *Dietes iridifolia* Salisb. in Trans. Hort. Soc. i, 307 (1812) ; *D. iridioides* and *D. catenulata* Sweet, Hort. Brit. ed. 2, 497 (1830) ; *D. compressa* and *D. catenulata* Klatt in Linnæa, xxxiv, 584–585 (1866) ; *D. crassifolia* Sweet, Hort. Brit. ed. 3, 661 (1839).

CALEDON DIVISION : Genadendal, *Prior* !. GEORGE DIVISION : forest near George, *Burchell* 6047 ! ; Kaymans Gat, *Drège* 4555 *a* !. UITENHAGE DIVISION : near Kowie River, *Burchell* 4011 !.

D. catenulata Sweet (*D. crassifolia*) is said to differ by having the outer petals downy instead of bearded along the keel of the claw-part and with a row of small yellow wart-spots on each side of the keel; but Miller's original figure of *D. vegeta* seems to represent something of this kind of marking. Are there two variations in the flower of the wild plants?

D. prolongata N. E. Br., comb. nov. Leaves 1–2 ft. long, 3–11 lines broad, spreading in fan-like manner. Flower-stem 2–6 ft. long, somewhat slender, branching and becoming decumbent and often producing young plants at some of the nodes. Perianth 1½ inch or perhaps less in diameter, bearded on the keel of the outer segments, white. *Moræa iridioides* var. *prolongata* Baker in Fl. Cap. vi, 26.

NATAL: Inanda, always at the edges of streams, *Wood* 1311, the type!; Dumisa, *Rudatis* 1411!. KENTANI DIVISION: near Kentani, in forest shade, *Pegler* 1163!.

Var. **Galpinii** N. E. Br., var. nov. Flower-stem 1–2 ft. long, erect, not producing young plants, otherwise as in the type in appearance, but flowers for examination are wanting.

TRANSVAAL: Near Barberton, in wooded ravines near running water, 3,500–4,000 ft., *Galpin* 1206, type!; Houtbosch *Rehmann* 5771!; Marovougn Forest, *Junod* 1215!.

The Transvaal plant may be distinct, but I have not seen properly-dried flowers that admit of comparison, and there seems to be no other difference in the specimens seen than that mentioned above.

I. CRISPA Thunb. Diss. Iris, 22, t. 1 (1782). Two sheets; both are **Morea crispa** Ker, and constitute the type of this species, as no specimen of it so named exists in the Linnean Herbarium. *Morea iriopetala* var. *juncea* Linn. f. is the same plant, the type of it in the Linnean Herbarium being only a depauperated form of *M. crispa* Ker (see note under *Iris tristis* below).

I. EDULIS Thunb. Diss. Iris, 24 (1782). Five sheets:—

α contains two species which I have marked A and B, A being **Morea angusta** Ker, and B a species that is unnamed, but is wrongly placed under *M. edulis* by Baker.

β is named *Iris edulis β. cærulea,* so the flowers are probably blue, and it is identical with the type of **Morea edulis** Linn. f. (1781) in the Linnean Herbarium, and is quite distinct from all the specimens at Kew named *M. edulis* by Baker: the two long leaves under the short inflorescence, the membranous and frayed margins of the bracts and particularly the *beaked* fruit, clearly distinguish this from allied species. The only specimen at Kew that is at all like it in bracts and fruit is *Schlechter* 10605, from near Saron, but this specimen differs, in the dried state, from Thunberg's in having only one long leaf under the inflorescence. The flowers may also differ.

γ is named *Iris edulis γ. flava* by Thunberg. I think it is the same plant as the specimen I have marked B on sheet α, and is an unnamed **Morea** wrongly referred to *M. edulis* by Baker in the Kew Herbarium. It is not *Homeria miniata* Sweet, as named by Klatt, nor *Morea longifolia* Sweet, as named by Baker on the sheet.

δ is **Morea pavonia** var. **lutea** Baker. *Vieusseuxia spiralis* De la Roche.

ε is **M. edulis** Linn. f. and is the same as β.

I. MINUTA Thunb. Diss. Iris, 8 (1782). One sheet containing two species, which I have marked A and B:—

A is **Morea minuta** Ker, which must be taken as being the type of this species, as no specimen so named exists in the Linnean Herbarium.

B is **Morea ciliata** Ker.

I. PAPILIONACEA Thunb. Diss. Iris, 23, t. 3 (1782). Three sheets.

All are **Morea papilionacea** Ker, and are identical with the type of *Iris papilionacea* Linn. f. (1781).

I. PAVONIA Thunb. Diss. Iris, 21, t. 1 (1782). Three sheets:—

α contains two species, which I have marked A and B:

A is **Morea pavonia** Ker, and is the type-specimen of Thunberg's figure. As no specimen of it exists in the Linnean Herbarium, this specimen must be accepted as the type. It is identical with the figure in Andr. Bot. Rep. t. 364!.

B is **Morea** sp. and is *M. pavonia* Ker in Bot. Mag. t. 1247, but not elsewhere. It has much smaller flowers with rounder petals and is differently marked from the true *M. pavonia*. I do not match either species in the Kew Herbarium, and neither of them is *Vieusseuxia villosa* Spreng, as named by Klatt.

β and γ are **Homeria elegans** Sweet.

I. PLUMARIA Thunb. Diss. Iris, 15 and 28 (1782). Two sheets.

Both are *Morea plumaria* Ker = *M. iriopetala* var. *vegeta* Linn. f.! (not *M. vegeta* L., see under *Iris compressa* Thunb.). *M. mira* Klatt!. Not *M. unguiculata* Gawl., as named by Klatt.

I. POLYSTACHYA Thunb. Diss. Iris, 25 (1782). One sheet.

Morea polystachya Ker. The type of the species!

I. RAMOSA Thunb. Diss. Iris, 18 (1782). One sheet.

Morea ramosissima Druce in Bot. Exch. Club Rep. Suppl. for 1916, p. 636 (1917) = *Iris ramosissima* Linn. f. (1781). *M. ramosa* Ker. As no specimen of this, so named, exists in the Linnean Herbarium, Thunberg's specimen must be accepted as the type.

I. SETACEA Thunb. Diss. Iris, 20, t. 1 (1782). One sheet.

This is **Helixyra setifolia** N. E. Br. Syn. *Morea setifolia* Druce, *Iris setifolia* Linn. f. (1781); *Morea setacea* Ker; *M. xerospatha* MacOwan !.

The type of this is Thunberg's specimen, but in the Smith Herbarium there is a specimen of this plant received from Thunberg in 1791, labelled by Thunberg "*Iris setifolia*," but with the last six letters of the specific name crossed out and the ending "*-acea*" written above them, making the name to read "*setacea*." As the name "*setifolia*" is the older it should be retained.

I. SPATHACEA Thunb. Diss. Iris, 17 (1782). One sheet.

This is **Morea spathulata** Klatt in Durand & Schinz, Consp. Fl. Afr. v. 152 (1893), and is identical with *Iris spathulata* Linn. f. (1781). The *Morea spathacea* Ker, as dealt with in Fl. Cap., is a mixture of three or more species. Thunberg's plant is identical with *Burchell* 5552 from Knysna Division and 6005 from near George. There is no specimen of it in the Linnean Herbarium.

As the specific name "*spathulata*" has priority, that name should be retained for this plant.

I. TRICUSPIS Thunb. Diss. Iris, 14 (1782). Five sheets:—

1 and 2. **Morea aristata** Aschers. & Graebn. Synop. Mitteleurop. Fl. iii, 518 (1906). *Vieusseuxia aristata* Houtt. Handl. xii, 92, t. 80. f. 1 (1780); *Iris tricuspidata* Linn. f. (1781); *Vieusseuxia glaucopis* DC. (1803); *Morea glaucopis* Drap. (1836).

Although the figures in Houttuyn's 'Handleiding' are usually fairly good, the coloration of them is execrable and very misleading unless the description is consulted. The flower in the figure quoted is coloured uniformly pale and dingy yellow, but is correctly described as white, with a purple spot at the base of the limb of the outer perianth-segments; otherwise the figure clearly represents the plant known as *Morea glaucopis*, and agrees with the type of *Iris tricuspidata* Linn. f., of which there is an authentic specimen in the Smith Herbarium, received from Thunberg in 1791. It is not the same plant as that figured in the 'Botanical Magazine' at t. 696 as *Morea tricuspis* var. *α*, nor is Thunberg's plant, *Vieusseuxia villosa* Spreng., as named by Klatt on the sheet.

3 seems different from the plant on sheets 1 and 2, and Klatt may be right in naming it *Vieusseuxia Bellendeni* Sweet.

4 is **Morea villosa** Ker.

5 contains two species, which I have marked A and B:

A is probably **Morea tricuspis** Ker, as to Bot. Mag. t. 696. It is not *M. aristata* Aschers. & Graebn.

B is a species of **Morea,** which is the same as *Burchell* 6386, placed under *M. polyanthos* Thunb. by Baker. Neither specimen is *Homeria miniata* as named by Klatt.

I. TRIPETALA Thunb. Diss. Iris, 13 (1782). Four sheets :—

α is **Morea tripetala** Ker, and is the same as *Iris tripetala* Linn. f. (1781), and not *M. angusta* as named by Klatt.

β contains two species, which I have marked A and B :

A is a species of **Morea** near *M. monophylla* Baker, not matched at Kew. It is not *Vieusseuxia tripetaloides* DC., and as named by Klatt.

B is **Morea** sp., not exactly matched at Kew. I doubt if it is *Vieusseuxia Bellendeni* Sweet, as named by Klatt.

γ is possibly a small form of **Morea tripetala** Ker.

δ contains two specimens, which may belong to different species, as the leaves of the two seem to differ in structure. The locality "Picketberg" is written on this sheet.

I. TRISTIS Thunb. Diss. Iris, 25 (1782). Two sheets; both are **Morea juncea** L. (1762)!, not of Baker in Fl. Cap. vi, 15, and also = *Iris tristis* Linn. f. (1781).

This plant must be taken as the type-species upon which the genus **Morea** was founded by Miller. The name of this genus was incorrectly spelled by Linné, and his error repeated by subsequent authors.

Miller, in his 'Figures of Plants,' ii, 159, t. 238, published in the part of the work issued June 27th, 1758 (the date for the whole volume being given on the titlepage as 1760), describes and well figures a plant upon which he founds and properly characterizes the genus **Morea** "in honour of Robert More Esquire of Shropshire." On plate 238 two specimens are represented, which, except as to the size of their flowers, are identical. Miller, however, considered them to belong to different species, because one has rather larger flowers than the other, and, as he thought, one produced only one flower and the other two from each flower-cluster, although on the plate both specimens are represented as producing two flowers from the clusters. There can be no doubt that the two specimens belong to the same species. The generic description and the descriptions of these two specimens occupy one chapter of the book. In the next chapter and on plate 239, fig. 1, another plant (*Iris compressa,* which see) is described and figured as being a species of *Morea,* but Miller did not give a specific name to either of the species.

Linné, in the second edition of his 'Species Plantarium,' 59, published in 1762, accepts Miller's genus and gives the specific names "*vegeta*" and "*juncea,*" respectively, to the two species placed under it, but alters the spelling of the generic name to *Moræa,* an error that has persisted ever since. Even Miller uses Linné's spelling in the eighth edition of his

'Gardener's Dictionary,' although in the text he uses his original spelling and repeats its derivation. No reason is given by Linné for altering the spelling, and this alteration is unwarrantable. In other genera founded upon surnames ending in "-e" Linné has not changed the final "-e" into "-æ," as, for example, *Sloanea* L., after Sir Hans Sloane, *Petrea* L., after Lord Petre, and *Lechea* L., after J. Leche, etc. It is probable that the similarity of the name *Morea* to his wife's maiden name *Moræus* led to his misspelling it. However, as the genus *Morea* was published after 1753, properly characterised and figured, and well within the prescribed limits of acceptance, and as Linné accepted it as Miller's genus (see Linné, Gen. Plant. ed. 6, 27 [1767], where he copies the characters of the genus as given by Miller), there is no reason why Miller's original spelling should not be retained.

Linné has created further confusion by the way he has given names to the species figured by Miller without quoting Miller's descriptions or figures, the Linnean description being as follows:—

M. vegeta, foliis canaliculatis, Mill. Dict. Habitat in Africa.

M. juncea, foliis subulatis, Mill. Dict. Habitat in Africa.

From these inadequate and erroneous descriptions and references it is impossible to know to which of Miller's figures Linné intended to apply the specific names. His intentions are, however, made clear by entries in Linné's writing in his own copy of the second edition of his 'Species Plantarum' at the Linnean Society, which is interleaved and annotated by him, evidently in view of publishing a third edition. In this copy the descriptions, including the added and sometimes corrected written words are as follows:—

(1) *Moræa* (*vegeta*) spatha uniflora foliis gladiatis, Mill. Dict. Habitat in Africa, Cap. B. Spei. Rd. fibrosa.

(2) *Moræa* (*juncea*) spatha biflora foliis subulatis, Mill. Dict. Habitat in Africa, C. B. S. bulbosa.

On the intercalated leaf Linné has written the following copied from Miller's plate:—

Moræa spatha biflora, caule planifolio floribus minoribus, Mill. Ic. 159, t. 138. f. 1.

β Moræa spatha uniflora, caule planifolio floribus majoribus, Mill. Ic. 159, t. 138. f. 3.

Petala cærulea s. violacea s. purpurea; tribus exterioribus macula baseos flava. Radix bulbosa.

This, on account of the added word "bulbosa" to number 2, obviously was intended to be added to *M. juncea*, whereas *M. vegeta* has white flowers, and is not bulbous.

Miller, in his eighth edition of the 'Gardener's Dictionary,' has correctly applied the Linnean specific names to the plants he had figured in his 'Figures of Plants' on tt. 238 & 239. Therefore the genus **Morea** starts with these two species, of which **M. juncea** L. must be accepted as the type, for not only is it the first to be described and placed, together with the generic character, in a chapter by itself, but it is evidently the species from which the fruit was characterised. **M. vegeta** L., on account of its root-stock being a rhizome instead of a corm, its laterally flattened leaves and other characters that distinguish it from all true species of *Morea*, must be removed from that genus and the name **Dietes** imposed upon it by Salisbury retained for it, as I have indicated under *Iris compressa* Thunb.

The plants in the Linnean Herbarium named "*M. vegeta*" and "*M. juncea*" are (as already stated under *Iris compressa* Thunb.) in no sense types of those specific names, and in no way correspond to Miller's figures, for they are marked on the sheets as having been collected by Sparrmann, either between April and November 1772 or between March 1775 and April 1776, the only periods when Sparrmann was in South Africa. These specimens could not have been seen by Linné until at least ten years after he had published the specific names "*vegeta*" and "*juncea*." The younger Linné seems to have recognised this and considered the two plants to be varieties of one species, which he called *M. iriopetala* var. *α juncea* and var. *β vegeta*. As these two names represent two distinct species, it may make matters clearer if I here set forth the synonymy of the four plants in question:—

MOREA VEGETA L. (1762), founded upon *Morea spatha uniflora, foliis gladiatis, radice fibrosa*, Miller, 'Figures of Plants,' ii. 159, t. 239. f. 1, is **Dietes vegeta** N. E. Br. *Morea iridioides* Linn. f. (1781); *Iris compressa* Linn. f. (1781). Not *M. vegeta* Jacq. nor of Murray, Syst. Veg. ed. 13.

M. JUNCEA L. (1762), founded upon *Morea spatha biflora* and *M. spatha uniflora*, &c., Miller, 'Figures of Plants,' ii. 159, t. 238. This is **Morea juncea** L. *M. tristis* Ker; *Iris tristis* Linn. f. (1781); *M. vegeta* Murray, Syst. Veg. ed. 13, 79 (1774), not of Linné.

M. IRIOPETALA var. VEGETA Linn. f. (1781), excluding the reference to Murray, Syst. Veg. ed. 13, 79 (1774), which belongs to *M. juncea* L. This is **M. plumaria** Ker. *Iris plumaria* Thunb. (1782); *M. mira* Klatt (1885).

M. IRIOPETALA var. JUNCEA Linn. f. (1781). This is only a depauperated form of **Morea crispa** Ker. It is the plant described as *M. juncea* by Baker in Fl. Cap. vi, 15, but is not *M. juncea* L. It agrees with *Wright* 257 from Simons Bay, named by Baker "*M. crispa* var. *rectifolia* Baker," but is not the same as the plant figured as *M. crispa* in Bot. Mag. t. 759, which Baker quotes for this variety.

In my opinion the name *M. iriopetala* cannot be maintained, as it was founded upon two distinct species, which were both described by Thunberg in the following year, and have long been recognised as distinct.

I. VIRGINICA Thunb. Diss. Iris, 16 (1782). One sheet.
This is not a South African plant. It is named *I. Gueldenstaedtii* by Klatt.

I. VISCARIA Thunb. Diss. Iris, 26 (1782). One sheet.
This is **Morea viscaria** Ker, and the type of the species, as no specimen of it so named exists in the Linnean Herbarium.

IXIA L.

IXIA ARISTATA Thunb. Diss. Ixia, 14 (1784). Four sheets, each containing a different species. Of these it seems that the specimens on sheet *α* must be considered as the type of the species, because (if we exclude the words "pedalis et ultra" and flowers "quinque usque novem") they best conform to the description. The words "palmaris" and flowers "rarissime unicus rarius duo" and "folia scapo dimidio breviora" could have been taken only from the specimens on sheet *α* and the other characters given agree with those specimens. They are the only ones that have a corm, so that Thunberg could not have described that organ from any other. Therefore, as Thunberg's name is older than Ker's, it must be retained for one of the plants that Thunberg intended should bear it and a new name given to *Ixia aristata* Ker, which is a different species. The synonymy is as follows:—

α. **I. aristata** Thunb. (1784), not of Ker nor of Baker. *I. leucantha* var. *aristata* Baker. This plant is identical with that distributed by Drège under the wrong name of "*I. conica* Salisb." collected between Slangheuvel, French Hoek, and Donker Hook. It is placed by Baker under *I. leucantha* Jacq., which is a different species, being very much taller, with broader leaves, white bracts, and many flowers in a spike. *I. aristata* Thunb. is only 6–7 inches high. It has a corm 5–6 lines in diameter, clothed with pallid hair-like fibres ¾–1 inch long, and has 4–5 leaves to a plant, 2–3 inches long, 1 line broad, linear, acute, erect, all rising to about one level and only about half as long as the stem, which bears 1–2 erect flowers. Bracts suborbicular, with 3 short subulate teeth, smoky-brown. Perianth-tube 1 line long; segments 7 lines long, 3½ lines broad, elliptic-oblong, obtuse, apparently white or creamy-white inside, flushed purplish on the back. It is not *I. conica* Salisb. as named by Klatt.

β is **Ixia elegans** N. E. Br., comb. nov. *I. aristata* var. *elegans* Baker, Handb. Irid. 162, not of Fl. Cap. *Wurthia elegans* Regel, *Gartenfl.* 1853, 98, t. 46. f. 2.

Thunberg's specimen on this sheet is identical with a specimen, the only one in Kew Herbarium that matches it, collected by Dr. Thom, which is unfortunately without a locality. The specimen from Swellendam, *Zeyher* 4014, referred to this species by Baker in Fl. Cap. vi, 79, is **Ixia polystachya** L., the true plant, and distinct from several of the specimens so named by Baker. Thunberg's specimen is not *I. patens* Gawl. as named by Klatt.

γ is **Ixia** sp. I do not find any specimen in Kew Herbarium that matches this. Its leaves are nearly as long as the stem, a character that does not agree with Thunberg's description.

δ is **Ixia micrandra** Baker, and is not *I. patens* Ait, or *I. leucantha* Jacq., or *I. candida* Red. as named by Klatt.

For the plant that has hitherto been called *I. aristata* Ker, I propose the name **Ixia longituba** N. E. Br., nom. nov. Syn.: *I. aristata* Ker in Bot. Mag. t. 589 (1802), not of Thunberg.

SWELLENDAM DIVISION: between Zondereinde River and Breede River, *Zeyher* 4016 !.

I. BICOLOR Thunb. Diss. Ixia, 15 (1783). Two sheets :—

α. The plant on this sheet is named by Baker *Geissorhiza purpureo-lutea* Baker. The latter, however, is a different species, with stouter leaves and very much smaller flowers with a short tube entirely included within the bracts, and not nearly twice as long as the bracts as they are in Thunberg's plant, which is not represented at Kew. Thunberg's plant may be regarded as a distinct species, of which the following is a description :—

Geissorhiza bicolor N. E. Br., comb. nov. *Ixia bicolor* Thunb. Plant 2½–3½ inches high. Leaves about three to a plant, 2–3½ inches long, ⅓–1 line broad, filiform or linear, curved, glabrous and not glutinous. Stem 1–2-flowered, rather shorter than the leaves. Flowers sessile. Bracts 3–4 lines long, obtuse and entire or scarcely notched at the apex, green, tinged with brownish at the apex. Perianth-tube about 5 lines long and much exceeding the bracts, narrowly funnel-shaped ; segments about 7 lines long and 2½ lines broad, elliptic-oblong, obtuse, bright yellow, with the base and the throat of the tube blackish-purple (or, according to Thunberg, blue). Stamens and style attaining to more than half the length of the perianth-segments; stigmas about 1¼ line long.

South Africa, without precise locality, *Thunberg* !.

β agrees with a specimen at Kew collected by Pappe on Cape Flats and named by Baker **Geissorhiza humilis** var. **grandiflora** Baker. It is not *Trichonema caulescens* Gawl., as named by Klatt.

IXIA BULBIFERA Thunb. Diss. Ixia, 15 (1783). Four sheets:—

β is **Sparaxis bulbifera** Ker.

γ and δ are **Sparaxis fimbriata** Ker. Not *S. grandiflora*, as named by Klatt.

ϵ is **Sparaxis atropurpurea** Klatt.

I. BULBOCODIUM Thunb. Diss. Ixia, 6 (1783). Two sheets from S. Africa:—

α is **Romulea similis** Eckl. according to Baker; it is not *Trichonema cruciatum* Gawl., as named by Klatt.

γ is **Romulea rosea** Eckl. according to Baker. It is the same plant as *Zeyher* 1605! with brown margins to the inner bract. It is not *Trichonema ochroleucum* Ker, as named by Klatt.

ϵ is **Romulea rosea** Eckl. according to Baker, but I very much doubt the correctness of this identification.

I. CAPILLARIS Thunb. Diss. Ixia, 12, with a reduced fig. (1783). Two sheets. Both are **Ixia capillaris** Linn. f. Suppl. 92 (1781) and Thunb. Diss. Ixia, 12, with fig. (1783). I cannot match this species with any specimen in Kew Herbarium. It bears no resemblance either generically or specifically to *I. linearis* Thunb. (see below), with which Baker has united it in Fl. Cap. vi, 83, nor is it the same as the specimens (*MacOwan* 2657, Herb. Norm. 262, and *Burchell* 6118) quoted by him as being *I. linearis*, nor at all like *I. capillaris* var. *gracillima* Ker in Bot. Mag. t. 570. I therefore give the following description of it:—

I. capillaris Linn. f. Corm 5 lines in diameter, globose, clothed with fine reticulated fibres. Leaves glabrous, 2–3 at the base, erect, 3–6 inches long, ½–¾ line broad, linear, subacute, with a midrib and thick edges at the laterally flattened upper part, besides one long sheath-like leaf extending mostly for three-quarters of the way up the stem, with a short, free, erect blade 1–2 inches long, stem 10–19 inches high, ½–¾ line thick at the base, erect, not flexuose, glabrous, the flowering part about 1–1¾ inch long, 1–4-flowered (Thunberg's figure represents it as 6-flowered), one or two of the lowest flowers on distinct pedicels 2–4 lines long, the others sessile, all ascending. Bracts 4½–5 lines long, 3-toothed at the apex, submembranous, pale brownish, with three dark brown ribs. Perianth-tube 2–3 lines long, funnel-shaped, included in the bracts; segments 6–7 lines long, 2–2½ lines broad, oblong or elliptic-oblong, obtuse, "whitish, reticulately veined" according to Thunberg. Filaments of the stamens exserted about 2½ lines from the tube; anthers 2¼–2½ lines long. Style about 4 lines long and about equalling the staminal filaments; stigmas 1 line long, filiform, entire, recurved.

South Africa: locality unknown, *Thunberg*!.

Thunberg's specimens must be accepted as the type of this species, as there is no named specimen of the plant in the Linnean Herbarium, either of the father or of the son.

As the specimens quoted by Baker for *I. linearis* represent two different species (*MacOwan* 2657 and 262 being one species, and *Burchell* 6118 being another !), and as Baker's description agrees with neither, they require to be renamed and described.

I. CINNAMOMEA Thunb. Diss. Ixia, 10, with fig. (1783). One sheet.

This is **Hesperantha cinnamomea** Ker, and agrees with the type of *I. cinnamomea* Linn. f.

I. COCCINEA Thunb. *Fl. Cap.* 1st ed. 207 (1811). Two sheets :—

α is **Ixia speciosa** Andr.

β is **Ixia patens** Ait.

I. CORYMBOSA Thunb. Diss. Ixia, 11 (1783). Two sheets :—

α is **Lapeyrousia purpureolutea** Baker, equals *Schlechter* 10622 collected near Saron in Tulbagh Division !. The type of *L. purpureolutea*, Tulbagh, *Thom*, consists of four specimens, on one of which the violet spot described by Baker is well marked, on another it is very small and faint, and on the other two there is no evidence of any spot, nor is any spot visible on Thunberg's specimen. The edges of the leaf are sometimes crisped as Thunberg describes, sometimes not so.

β is **Lapeyrousia azurea** Eckl.

I. CRISPA Thunb. Diss. Ixia, 9 (1783). Two sheets ; both are **Tritonia undulata** Baker, and match the type of *Ixia crispa* Linn. f.

I. CROCATA Thunb. Diss. Ixia, 17 (1783). Two sheets :—

α is **Tritonia crocata** Ker.

β is **Tritonia deusta** Ker.

I. CROCEA Thunb. Fl. Cap. 1st. ed. 218 (1811). One sheet.

This is **Romulea sublutea** Baker=*Ixia sublutea* Lam. (1789). It is not *Trichonema speciosum* Ker as named by Klatt.

I. ELLIPTICA Thunb. in Hoffm. Phyt. Blatt. 4 (1803). One sheet.

This is **Lapeyrousia juncea** Pourr. On the back of the sheet is written by Thunberg, "Cult. in Horto Kewensi, *Afzelius*." *Gladiolus junceus* Thunb. is the same plant.

I. ERECTA Thunb. Diss. Ixia, 16 (1783). Three sheets, all **I. erecta** Thunb. but not *I. erecta* Berg, which is a synonym of *I. polystachya* L.

Thunberg's plant is the same as *Sieber* 130 and *Ecklon* 442 (issued as *I. monadelpha*). It has very broad leaves (3–7 lines broad), with the flowers very closely placed on the spike, and is quite distinct from *I. erecta* Berg, which has narrower leaves and the flowers lax and rather distant on the spike.

I. EXCISA Thunb. Diss. Ixia, 19 (1783). Two sheets :—

α is **Geissorhiza excisa** Ker, and is the same as the type of *Ixia excisa* Linn. f. (1781).

β is a species of **Geissorhiza** that I do not match at Kew. It is not like *G. recurvifolia* Klatt as named by Klatt, nor is it *G. Dregei* Baker, to which Baker has referred it. Thunberg's plant differs from *G. Dregei* by its thicker and less acute leaves, larger and peculiarly speckled bracts, and yellow flowers, which in places have turned green, but do not have a black blotch at the base of the segments as in *G. Dregei.*

I. FALCATA Thunb. Diss. Ixia, 19, with fig. (1783). Four sheets :—

α and β are **Hesperantha falcata** Ker, and identical with the type of *Ixia falcata* Linn. f.

γ contains two species. Three specimens on the sheet belong to **Hesperantha pilosa** Ker. The fourth specimen I am unable to determine. It is not *Hesperantha graminifolia* as named by Klatt.

δ is not *Hesperantha falcata* Ker, as named by Klatt, nor *Geissorhiza Brehmii* Eckl. as named by Baker, but appears to be a small-flowered form of (or a species allied to) the plant Baker has called **G. imbricata** Ker.

I. FENESTRATA Thunb. in Hoffm. Phyt. Blatt. 4 (1803). One sheet.

This is **Tritonia laxifolia** Benth. On the back of the sheet the locality is given as between Sunday River and Fish River.

I. FRUTICOSA Thunb. Diss. Ixia, 5 (1783). One sheet.

This is **Nivenia fruticosa** Baker. *Ixia fruticosa* Linn. f. (1781) (I have compared it with the Linnean type) ; *Aristea fruticosa* Pers. ; *Witsenia ramosa* Thunb. (1811) ; *W. fruticosa* Ker.

I. HIRTA Thunb. Diss. Ixia, 9 (1783). One sheet.

This is **Geissorhiza hirta** Ker. It is not *G. quinquangularis* Eckl. as named by Klatt.

I. HUMILIS Thunb. Diss. Ixia, 8 (1783). Four sheets :—

α is **Geissorhiza humilis** Ker.

β and γ contain specimens of a species that I fail to match in Kew Herbarium. It is nearest *Geissorhiza humilis* var. *grandiflora* Baker, but the bracts and flowers seem different. It is not *G. Brehmii* Eckl. as named by Klatt.

δ is **Geissorhiza graminifolia** var. **bicolor** Baker, and is the same as MacOwan, Herb. Norm. 261. It is not *G. quinqangularis* Eckl. as named by Klatt.

I. LANCEA Thunb. Diss. Ixia, 18 (1783). One sheet containing five good specimens of a species which I do not match with any specimen at Kew. It is not *Tritonia crispa* Ker as named by Klatt. Although resembling that species in general appearance, it differs by its lanceolate acute glabrous leaves being entire with inrolled margins (not at all crisped) and 1½–2½ inches long and 2–4 lines broad, or some of them narrower and linear from the margins being very inrolled. The bracts are much as they are in *T. crispa*, but the perianth-tube is only 7–9 lines long and exserted only 5–6 lines beyond the bracts ; the perianth-segments are 6–8 lines long and 3–4 lines broad, elliptic-oblong, obtuse, apparently white, with the three outer segments purplish on the back.

The name *I. lancea* has been omitted by Baker from the 'Flora Capensis,' and as the plant is different from *Ixia lancea* Jacq. I propose to retain the much older name and call the plant :—

Tritonia lancea N. E. Br., comb. nov. ; *Ixia lancea* Thunb. (1783), not *I. lancea* Jacq. (1796).

PIQUETBERG DIVISION : Piquetberg, *Thunberg* !.

I. LINEARIS Thunb. Diss. Ixia, 12 (1783). One sheet.

This plant is also *I. linearis* Linn. f., but bears no resemblance to that described and quoted as being *Ixia linearis* by Baker in Fl. Cap. vi, 83, and is identical with *Gladiolus biflorus* Klatt !. It is not *G. debilis* Sims as named by Klatt. As Linné's name has priority I propose to retain it for this species, which is a *Gladiolus* and not an *Ixia*, and call it

Gladiolus linearis N. E. Br., comb. nov. *Ixia linearis* Linn. (1781) and of Thunb. (1783) ; *Gladiolus biflorus* Klatt in Trans. S. Afr. Phil. Soc. iii, 197 (1885).

CAPE DIVISION : Cape Flats ; between Cape Town and Stellenbosch, *Thunberg* ! ; near Wynberg, *MacOwan* 2279, and *Herb. Norm.* 279 !. MacOwan's specimens agree with the type !.

I. MACULATA Thunb. Diss. Ixia, 16 (1783). Nine sheets :—

α is **Tritonia stricta** Klatt and is *Zeyher* 4008. It is not *I. retusa* as named by Klatt.

β is a species of **Ixia** which I do not match at Kew. It is not like *Gladiolus debilis* Sims, as named by Klatt.

γ is named *Ixia conica* Salisb. by Klatt, but I doubt the correctness of the identification.

ζ is **Ixia columellaris** Ker.

ι is **Ixia monadelpha** De la Roche, not *I. capillaris*, Bot. Mag., as named by Klatt.

The other four sheets appear to contain variations of **Ixia maculata** L.

I. MINUTA Thunb. Diss. Ixia, 6, with fig. (1783).

This is **Pauridia minuta** Dur. & Schinz. Syn. *P. hypoxidoides* Harv. and is the same as *Ixia minuta* Linn. f. (1781). As Linné's specific name is much the older it must take precedence.

I. MONANTHOS Thunb. Fl. Cap. 1st ed. 226 (1811). One sheet.

This is **Geissorhiza Bellendeni** MacOwan (*Ixia monanthos* Thunb., not of De la Roche). It is not *G. Rocheana* Sweet, as named by Klatt.

I. PENDULA Thunb. Diss. Ixia, 15 (1783). One sheet.

Thunberg's specimen of this plant is identical with that in the Linnean Herbarium on which the species was founded.

It is **Dierama pendula** Baker, but under this name Baker has confused two or three other species. The type is a native of Uitenhage and Humandorp Divisions, *Zeyher* 918.

I. PENTANDRA Thunb. Diss. Ixia, 18 (1783). Two sheets.

Both are **Tritonia scillaris** Baker, one being a remarkable pentandrous form, and the same as *Ixia pentandra* Linn. f. (1781).

I. PILOSA Thunb. Diss. Ixia, 8 (1783). One sheet, containing three distinct species. One is **Hesperantha pilosa** Ker. Another may be **Hesperantha falcata** Ker. The third seems to be a species of **Geissorhiza** near *G. pauciflora* Baker, but with a different corm. No named specimen of *Ixia pilosa* Linn. f. exists in the Linnean Herbarium, therefore Thunberg's specimen of it must be accepted as the type.

I. POLYSTACHYA Thunb. Fl. Cap. 1st ed. 240 (1811). Two sheets :—

α is **Ixia polystachya** L., not *I. dubia* Vent., as named by Klatt.

β is a species of **Ixia** I cannot determine ; it is not *I. conica* Salisb. as named by Klatt. The flowers appear to have been rosy or purplish.

I. RADIANS Thunb. in Hoff. Phyt. Blatt. 3 (1803). Two sheets; both are **Geissorhiza rochensis** Ker.

I. REFLEXA Thunb. Fl. Cap. 1st ed. 220, (1811). Five sheets :—

α, β, γ, and δ are **Romulea bulbocodioides** Baker.

ε is **R. bulbocodioides** var. **elongata** Baker.

I. RETICULATA Thunb. Fl. Cap. ed. Schultes, 60 (1823). One sheet.

This is **Tritonia lineata** Ker.

I. SCARIOSA Thunb. Fl. Cap. 1st ed. 243 (1811). One sheet.

This is **I. scariosa** Thunb., but may possibly be the same as *I. incarnata* Jacq. Ic. Rar. t. 282 (1796). Jacquin, however, represents the stem as simple, while Thunberg's plant, even in small weak specimens, has a branching flower-stem. The stamens of this species are nearly as long as the perianth-segments. It is the same plant as *Bolus* 14278, but distinct from *MacOwan and Bolus*, *Herb. Norm.* 698, which is a very similar plant, but has larger flowers and shorter stamens, and comes from a different region. Thunberg's plant is not *I. capillaris*, Bot. Mag., as named by Klatt. Written on the back of the sheet by Thunberg is the locality "Cold Bokkeveld," which is not mentioned in his 'Flora Capensis.'

I. SCILLARIS Thunb. Diss. Ixia, 13 (1783). Two sheets :—

α is **Geissorhiza setifolia** Eckl., not of Baker. It is not *G. setacea* Ker as named by Klatt.

β is neither *Geissorhiza setacea* Ker, as named by Klatt, nor *G. humilis* var. *bicolor* Baker, to which Baker has referred it in the Fl. Cap. vi, 67, and I am unable to match it at Kew in the genera *Geissorhiza*, *Ixia*, *Lapeyrousia*, or *Hesperantha*. It appears to be a true **Geissorhiza.**

I. SECUNDA Thunb. Diss. Ixia, 9 (1783). Two sheets :—

α is **Geissorhiza secunda** Ker.

β is **G. secunda** var. **ramosa** Klatt.

I. SETACEA Thunb. Diss. Ixia, 13 (1783). One sheet.

This is **Geissorhiza setacea** Baker.

I. SQUALIDA Thunb. in Hoffm. Phyt. Blatt. 4 (1803). One sheet.

This is **Tritonia securigera** Ker, and is the same as *Gladiolus securiger* Ait. (1789).

I. VIRIDIS Thunb. Fl. Cap. 1st ed. 242 (1811). Two sheets ; both are **I. viridiflora** Lam. (1789).

MOREA Miller.

(For the spelling of this name see note under *Iris tristis*, p. 40.)

M. AFRICANA Thunb. Diss. Mor. 7 (1787). Three sheets.

All are **Aristea africana** Hoffmannsegg, and are the same as *Ixia africana* L. (1753) and *Aristea cyanea* Ait. 1789.

M. APHYLLA Thunb. Diss. Mor. 9, t. 2 (1787). One sheet.

This is **Bobartia aphylla** Ker, *Morea aphylla* Linn. f., not of Baker ; *B. Keetii* Phillips !.

The description by Baker of *B. aphylla* in Fl. Cap. vi, 45, is founded upon two or more different species which are distinct from Thunberg's plant and are unnamed.

In the Smithian Herbarium at the Linnean Society is a specimen named *Ixia gladiata* by Linné (the type of **Bobartia gladiata** Ker), with the name "*aphylla*" written on it by Smith (?) ; but it is not the same plant as Thunberg's, which latter must be accepted as the type, since no specimen of it exists in the Linnean Herbarium.

M. BERMUDIANA Thunb. Diss. Mor. 7 (1787), placed under *Aristea* in his Herbarium. Three sheets marked as South African:—

α is **Aristea Eckloni** Baker, not *A. spiralis* Ker, as named by Klatt.
γ is **Aristea anceps** Eckl.
δ is apparently **Sisyrinchium angustifolium** Mill. not a South African plant.

M. CÆRULEA Thunb. Diss. Mor. 12, t. 2 (1787), named *Aristea cærulea* in Thunberg's Herbarium. Three sheets:—

α and γ are **Aristea cœrulea** Vahl.
β contains two species which I have marked A & B:
  A is **Aristea cœrulea** Vahl.
  B is **Aristea capitata** Ker.

M. CHINENSIS Thunb. Diss. Mor. 14 (1787). One sheet, marked as from the Cape. This is **Belemcanda chinensis** Lem., but is not a South African plant.

M. COLLINA Thunb. Diss. Mor. 11 (1787). Four sheets:—

1 is **Homeria collina** Vent.
2 by its very long flower-clusters agrees with **Morea grandiflora** Eckl. according to a specimen collected by *Zeyher* so named at Kew, but it is not *Homeria collina* as named by Klatt.
3 is **Morea gigantea** Klatt, not *Homeria miniata* Sweet as named by Klatt.
4 is **Homeria** species? in fruit. It is not *H. collina* Sweet, as named by Klatt.

M. CRISPA Thunb. Diss. Mor. 13 (1787). One sheet.

This is **M. undulata** Ker, and is the type of the species. The name was changed by Ker, because he had used the name *M. crispa* for a species (*Iris crispa* Linn. f.) to which this specific name had been earlier applied. I do not match Thunberg's specimens of *M. crispa* with any specimen at Kew.

The plant collected by *MacOwan* (no. 2102) quoted by Baker in Fl. Cap. vi, 20, as being *M. undulata* Ker, is a different species and at present unnamed.

M. DICHOTOMA Thunb. Prod. 186 (1880). One sheet, named *Aristea dichotoma* on the sheet.

This is **Aristea dichotoma** Ker, and the type of the species.

M. FILIFORMIS Thunb. Diss. Mor. 9, t. 1 (1787). One sheet.

This is **Bobartia filiformis** Ker=*Morea filiformis* Linn. f. It is the type of the species, as no specimen of it so named exists in the Linnean Herbarium. I do not quite match this small-flowered plant at Kew, for the specimens collected by *Kitching*, *Bolus*, and *Zeyher*, quoted for this species by Baker in Fl. Cap. vi, 44, do not belong to *B. filiformis* Ker, their flowers and bracts being much too large, and apparently represent an unnamed species.

M. FLEXUOSA Thunb. Diss. Mor. 10 (1784), Four sheets :—

α contains three specimens of **Hexaglottis flexuosa** Sweet (*Morea flexuosa* Linn. f. (1781), excluding reference to *Ixia longifolia* Jacq.), and one specimen of **Morea edulis** Ker.

β is also **Hexaglottis flexuosa** Sweet. This plant is not *H. longifolia* Vent., as named by Baker[*], nor *Homeria spicata* Sweet, as named by Klatt. I do not match Thunberg's specimens (which were collected in Tulbagh Division, near the Berg River, etc.) with any at Kew, but a plant that grows near Cape Town (*WolleyDod* 360, *Ecklon* 536, wrongly named *H. virgata* by Baker) is similar, although differing by its narrower and less flat leaves, less flexuose inflorescénce, and much more exserted flowers. Baker has wrongly referred this plant partly to *H. longifolia* Vent, and partly to *H. virgata* Sweet, yet it appears actually to be without a name. The figure (Bot. Mag. t. 695) of *Hexaglottis flexuosa* is not a very good one, the flexuose axis being badly represented. Thunberg's specimens must be accepted as the type of this species, as no specimen so named exists in the Linnean Herbarium.

γ contains two species, which I have marked A and B:

A is **Hexaglottis longifolia** Vent. and equals *Ixia longifolia* Jacq. Hort. Vind. iii, t. 90. This plant is different from *H. flexuosa*

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[*] It may be well to explain here that the descriptions and specimens quoted by Baker in Fl. Cap. vi, 32, for *Hexaglottis longifolia* and *H. virgata* apply to neither of those species. Of *H. longifolia* Vent., the only specimens I have seen are *Wolley Dod* 3479 and the bit on Sheet γ of *Morea flexuosa* in Thunberg's Herbarium. To *H. virgata* Sweet the following specimens belong:—*Zeyher* 1644, *Burchell* 252/1, *MacGillivray* 479, *Bolus* 2484, *MacOwan* 2055, *Schlechter* 9106. To the unnamed species above mentioned I should refer *Ecklon* 9 *b* and 536, *Burchell* 34 and 202, *Drège* (named "*Morea virgata* Jacq., *a*") and *Bolus* 3801, for all of which localities are given in the 'Fl[illegible] Capensis.'

Sweet, and none of the specimens (except this one piece) quoted by Baker for *H. longifolia* in Fl. Cap. vi, 32, belongs to it. The true *H. longifolia* is a much stouter plant with a straight flowering axis and much broader leaves than *H. flexuosa*, and appears to be a rare plant, the only specimen of it at Kew being *Wolley Dod* 3479, collected "by Orange Kloof swamp."

B is probably a species of **Morea,** which I do not match at Kew. Neither specimen is *Homeria miniata* Sweet as named by Klatt.

δ is probably a species of **Homeria.** It is certainly not *Hexaglottis longifolia* Vent., as named by Baker, nor *Homeria spicata* Sweet, as named by Klatt.

M. GLADIATA Thunb. Diss. Mor. 8 (1787). Two sheets.

Both are **Bobartia gladiata** Ker and are identical with the type of *Ixia gladiata* Linn. f. in Herb. Smith at the Linnean Society. *Morea gladiata* Murray, Syst. Veg. ed. 14, 93.

M. IRIDIOIDES Thunb. Diss. Mor. 14 (1787). One sheet.

This is **Dietes vegeta** N. E. Br. and equals *Morea vegeta* Linn. See under *Iris compressa* Thunb.

M. MELALEUCA Thunb. Diss. Mor. 5, t. 1 (1787). One sheet.

This should take the name of **Cleanthe lugens** Aschers. & Graeb. Synop. Mitteleurop. Fl. iii, 534 (1906), as the name *Morea lugens* Linn. f. was imposed upon it six years earlier than Thunberg's name, and should be maintained. The synonymy is as follows:—*M. lugens* Linn. f. Suppl. 99 (1781); *M. melaleuca* Thunb. (1787); *Cleanthe bicolor* Salisb. (1812). The reference to *Cleanthe melaleuca* Baker, given in Fl. Cap. vi, 47, is incorrect, for at the place quoted (Journ. Linn. Soc. xvi, 112) the name given is *Aristea melaleuca* Ker and the quotation "*Cleanthe melaleuca* Salisb." at that place is also wrong. I do not match this plant with any specimen at Kew. The type is in the Linnean Herbarium and Thunberg's specimens are identical with it.

M. OVATA Thunb. Prod. 186 (1800). One sheet.

This may possibly be **Lapeyrousia fissifolia** Ker in Konig & Sims, Ann. of Bot. i, 238 (1805), founded upon *Gladiolus fissifolius* Jacq. Ic. ii, t. 268, but it is not the plant of the Bot. Mag. t. 1246, nor of Baker, and I do not match Thunberg's specimens at Kew.

M. POLYANTHOS Thunb. Diss. Morr. 12 (1787). Two sheets.

Both are **Morea polyanthos** Linn. f. (1781). Thunberg's specimens constitute the type of this species. In the Smithian Herbarium at the Linnean Society is a luxuriant specimen of this species (like one on Sheet B of Thunberg's Herbarium) received from Thunberg in 1791, bearing the name "*Gladiolus junceus,*" the label having been transposed from a specimen of the real *G. junceus* (**Lapeyrousia juncea**), which bears the name *Morea polyanthos* in the same Herbarium. *M. polyanthos* L. f. is the same as *Zeyher* 4080 quoted by Baker for that species, but is not the same as the other numbers also quoted for it by Baker.

M. PUSILLA Thunb. Diss. Mor. 7 (1787), named *Aristea pusilla* on the only sheet of it.

This is **Aristea pusilla** Ker.

M. SPATHACEA Thunb. Diss. Mor. 9, t. 1 (1787). One sheet.

This is **Bobartia indica** L. (1753) !, and is the same as *B. spathacea* Ker (1827). Thunberg's plant is identical with the type-specimen of *Bobartia indica* L. in Hermann's Herbarium, now at the British Museum. The type is in very young flowering condition, hence Linné's inaccurate description of it. As it was mixed by Hermann with his Ceylonese specimens, it was thought by Linné to have come from that country.

Bobartia was originally published by Linné in 1847 in his 'Flora Zeylanica,' 17, and in the same year by Dassow ('Nova Plantarum Genera'), republished in Linnæus, 'Amœnitates Academicæ,' i, 387 (1749). It was so inaccurately described that it could not be identified, and twenty years later Gahn, "Fundamenta Agrostographiæ," in Linnæus, 'Amœnitates Academicæ,' vii, 183, t. 2, f. 6 (1767), figured as being *Bobartia* some species of *Xyris*, which he had mistaken for that genus. It is evident that his figure could not possibly have been made from the Linnæn type in Hermann's Herbarium.

M. SPIRALIS Thunb. Diss. Mor. 6 (1787). One sheet.

This is **Aristea spiralis** Ker=*Morea spiralis* Linn. f. (1781). As no specimen so named exists in the Linnean Herbarium, Thunberg's specimen must be accepted as the type.

M. UMBELLATA Thunb. Diss. Mor. 13 (1787). Two sheets:—

α is **Morea umbellata** Thunb. The type-specimen of the species. It is the same plant as *Zeyher* 4087, and is distinct from *M. edulis* Ker.

β. This is not the same as *M. umbellata* Thunb., nor is it *M. edulis* Ker as named by Klatt. It is the same as a specimen at Kew collected by Wallich.

M. UNDULATA Thunb. Diss. Mor. 14 (1787). Two sheets.

Both are **Ferraria undulata** L.

WITSENIA Thunb.

W. MAURA Thunb. Nov. Gen. Pl. 34, with fig. (1782). Two sheets.
Both are **Witsenia maura** Thunb.

W. RAMOSA Thunb. Fl. Cap. 1st ed. 2nd part, 256 (1811). One sheet named *W. fruticosa.*

This is **Nivenia fruticosa** Baker. *Ixia fruticosa* Linn. f. Suppl. 93 (1781) and Thunb. Diss. Ixia, 5 (1783). *Aristea fruticosa* Pers.; *Witsenia fruticosa* Ker; *W. ramosa* Thunb.

The Genus *Festuca* in New Zealand.

By W. O. HOWARTH, M.Sc., F.L.S.

(With 23 Text-figures.)

[Read 1st March, 1928.]

INTRODUCTION.

THE list of New Zealand *Festucæ* given by Hooker (1853–55 and 1864–67) comprises the following :—*Festuca littoralis* Labill.; *F. scoparia* Hook. f.; *F. duriuscula* L.; *F. bromoides* L., the first two being regarded as not represented in our northern latitudes.

Buchanan (1880) followed Hooker, but shortly afterwards Hackel published his monograph of European *Festucæ* (1882), and this appears to have led to a more critical study of these grasses in New Zealand—in fact, a number of grasses were sent to Hackel, who communicated his observations to the New Zealand Institute (1903). Cheeseman (1906) largely draws on Hackel in giving the following list :—*Festuca littoralis* Labill.; *F. ovina* subsp. *novæ-zelandiæ* Hack.; *F. ovina* subsp. *Matthewsii* Hack.; *F. rubra* L.; *F. contracta* T. Kirke; *F. Coxii* Hack. He describes *F. scoparia* Hook. under *Poa litorosa* Cheesem., and under *F. rubra* L. says that according to Hackel this constitutes the greater part of Hooker's *F. duriuscula* L., the true *F. duriuscula* not existing in an indigenous state in New Zealand.

In his monograph Hackel (1882) places *F. duriuscula* L. under *F. ovina* L., *sensu ampliss.*, as a variety, but I have shown (1923) that the true Linnean *Festuca duriuscula* is a form of *F. rubra* corresponding to *F. rubra* var. *fallax* as conceived by Hackel. I am interested to have further confirmation of this view, for a sheet from New Zealand in Hooker's Herbarium at Kew labelled *F. duriuscula* L. bears what I determine as *F. rubra* var. *fallax* Hack. (see below). It is unfortunate that Hackel in his correspondence with Cheeseman did not indicate which of his numerous varieties of *F. rubra* he had recognised amongst those sent to him.

In the further study of the New Zealand grasses we owe much to D. Petrie, who has not only collected widely, but has grown the plants under observation and submitted specimens to Kew for the opinion of Dr. O. Stapf. He has shown (1920) that *F. contracta* Kirk (1895) is really *F. erecta* D'Urv., and that its occurrence in New Zealand gives this grass a circumpolar distribution. He also records *F. fallax* Thuill. and *F. dura* Host as identified by Stapf. I have seen this material and can confirm the first, but do not agree with the second determination (see under var. *fallax* below).

The accumulated results of the work on the fescues are given in the second edition of Cheeseman's Manual (1925). His list is :—*Festuca littoralis* Labill.;

F. novæ-zelandiæ Cockayne; *F. Matthewsii* Cheesem.; *F. rubra* L.; *F. multinodis* Hack. et Petrie; *F. erecta* D'Urv.; *F. Coxii* Hack.

It will be seen that *F. novæ-zelandiæ* and *F. Matthewsii* have been raised to species, and that a new species has been added. Cockayne (1916) gives *F. novæ-zelandiæ* as a species in a list of plants under "Plant-associations at Caso," without assigning any reason for so doing. *F. multinodis* is described for the first time in a communication to the New Zealand Institute in 1912.

Cheeseman's list is still, however, incomplete, particularly in the way in which he deals with *F. ovina* and *F. rubra*, and it was with a view to analysing these forms further that I undertook to examine a collection of fescues owned by Prof. Arnold Wall, of Christchurch, New Zealand, representing gatherings made by himself, Petrie, and others. I have also examined the collections at Kew, the British Museum (Natural History), Oxford, and the private collection of Mr. J. Cosmo Melvill.

I had already completed this account when two papers by Cockayne and Allan appeared. In one they recognise the necessity of a complete revision of *Festuca rubra* as given by Cheeseman, since this name may apply to any of a large number of forms. To quote from their remarks (1926): "It seems to us to serve no useful purpose to include *F. rubra* L. in the New Zealand Flora as a sort of dumping-ground for forms of *Festucæ* for which we cannot find a more suitable resting-place...... The whole matter will have to be investigated *de novo* in the field; it cannot be done abroad by the herbarium method." Now this is a statement depending for its truth on several factors, such as the acuteness of the collector, the distinctiveness of the material collected, and the experience of the investigator. Given the right material it should prove no difficult matter to separate out the main types under *F. ovina*, *F. rubra*, etc., along Hackelian lines, and then to analyse these further in the same way. Thus Hooker recognised in the New Zealand flora that form of *F. rubra* L. Hack., which passed amongst the British botanists of his day as *F. duriuscula*. It was Hackel who consigned quite a different plant under this name to *F. ovina*, and, although I have found what I consider to be *F. ovina, duriuscula* Hack. in the material I have examined, I consider it to have been introduced. There was, I understand, a large introduction of European grasses into New Zealand shortly after the publication by Stebler and Schroeter (1889) of their work on forage-plants. Hackel's view as quoted by Cheeseman (1906) under *F. rubra* does not criticise Hooker, but confirms him, and is due to Hackel's misconception of *F. duriuscula* L.

In 1902, working from herbarium material supplied to him, Hackel described two well-defined types as subspecies under his rather broad conception of *F. ovina*, viz., *F. ovina, novæ-zelandiæ* and *F. ovina, Matthewsii*; he did not, however, give any indication of particular types under *F. rubra*, except perhaps in unpublished correspondence, suggested by Cheeseman's vague reference (1925) to possibly introduced European forms, and indubitable native varieties. Cockayne and Allan (1927) criticise Cheeseman for admitting *F. rubra* to the flora on Hackel's authority, because he gives neither diagnoses nor localities of these "varieties." Then they say: "It is certain that a great deal of hybridisation has occurred. Here is, therefore, a case where the task of arriving at the status of the various forms is one of great difficulty, if not of impossibility. To us it seems that only those forms which research shows in the 'jordanons' not occurring in other countries should be admitted to the flora. And it is obvious that no collection of herbarium specimens, however complete, could be satisfactorily determined by specialists, however expert, without the added information derived from field studies and experimental cultures." It is, of course, impossible to isolate true "jordanons" with herbarium material, and the extreme difficulty of doing it from living material is reflected in the comparatively small amount of genetical research which has been done so far on the constitution of the Linnean species. But it is a big step from the consideration of *Festuca rubra* to that of its component "jordanons," and much preparatory work can be done, and has been done, from herbarium material. As conceived by Hackel, *F. rubra* is subdivided into six subspecies, and these again into varieties, subvarieties, and even forms. Amongst these are outstanding types with readily recognisable characters. There may be intermediates between his subvarieties or even his varieties, which may suggest either hybridisation or evolutionary tendencies, and which can be studied only by experimental culture, but the broad groupings are on the whole sound. Since Hackel, the *Festucæ* have received further critical consideration in definite regions, *e.g.*, by Stebler and Schroeter in Switzerland, S. Belli in Italy, and A. St.-Yves in the Maritime Alps. Such work has been accomplished largely from a close study and careful sifting of dried material, and is useful in two ways: it aids the monographist to co-ordinate affinities and from the facts to make his generalisations, and arrive at a closer conception of a species; and, secondly, it assists anyone who desires to make a detailed investigation of species thus treated as represented in a definite region, and to recognise new ones. Carried out on scientific lines order is produced out of apparent chaos, and the confusion exists only in the minds of those who refuse to recognise such work.

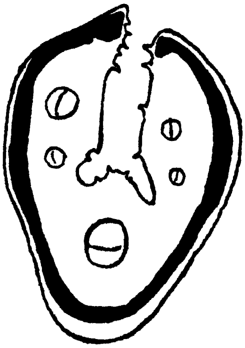
One is led to wonder if Cockayne and Allan are even yet able to distinguish between the forms *F. rubra* and *F. ovina* in their broadest sense, in spite of the amount of work done on the subject. Writing in 1910, Cockayne says:—"The tussock meadows of the montane regions and the plains are of great commercial importance. They are, in fact, the home of those vast flocks and herds on which the prosperity of the Dominion so largely depends. The study of their plants is therefore of high economic interest. Foremost come the grasses, replaced now in so many cases by those of

Europe and by the host of introduced weeds. Some of these indigenous grasses are most valuable for stock. The tussocks belong especially to two species—*Poa cæspitosa* and *Festuca rubra*. As a food for stock the *Poa* is not of much moment, but *Festuca rubra* is of considerable value." Now, contrast with this what Cockayne writes of apparently the same plant-formation in a second edition of the same work published in 1919. On page 86 we read: "The great tussock-grassland plant community falls into two distinct classes . . . . . Where the soil is specially sour . . . . . the red tussock *Danthonia Raoulii* var. *rubra* dominates; but where the climate is drier . . . . . one or other of the two tussocks—the silver-tussock (*Poa cæspitosa*) or the hard-tussock (*Festuca novæ-zelandiæ*)—is the physiognomic plant. As the *Danthonia* is a much 'taller tussock' than either of the other two, the two plant-formations may be known as 'tall tussock-grassland' and 'low tussock-grassland' respectively." On page 92: "It is low tussock-grassland which must specially be considered from the economic aspect . . . . . the association has supported millions of sheep for nearly seventy years . . . . . Certainly the number of sheep grazed per acre is very small, perhaps one to four acres being quite a liberal estimate . . . . . Evidently the tussocks *Poa cæspitosa* and *Festuca novæ-zelandiæ* are not relished by sheep." There is here no mention of *Festuca rubra*. It is clear, therefore, that Cockayne named *F. rubra* what was really *F. novæ-zelandiæ*, even though Hackel's description had been in print in New Zealand about seven years, and that he much over-estimated its value for stock. In Cockayne and Allan's (1927) most recent paper, the rather startling statement is made respecting *Festuca rubra*, and now apparently in the full appreciation of its distinctiveness from *F. novæ-zelandiæ*, that it really has very little value as a sheep-grass. If this is true for New Zealand, it is absolutely contrary to agricultural experience in England, or in Europe as a whole. From my lists below it will be seen that the forms of *F. rubra* occurring in New Zealand fall mainly under *F. rubra, genuina* Hack., and *F. rubra, fallax* Hack., and these same types are known to our British agriculturists as *F. rubra,* or red fescue, and *F. duriuscula,* or hard fescue. Speaking of *F. duriuscula* (*F. rubra, genuina*) Sowerby and Smith (1832) record that it is a common grass everywhere in pastures and meadows acceptable to all kinds of cattle. In 1842 Parnell says of the same grass that it ranks first among the grasses which are of most importance for agricultural purposes, and that sheep are remarkably fond of it. More recently Percival (1913) says that *F. duriuscula* and *F. ovina* are constituents of the best sheep pastures on the higher ground of Great Britain, and that the former may be used with advantage, in moderate amount, as a "bottom" grass in all mixtures for permanent pastures in dry situations. *F. rubra, fallax*, from New Zealand, thought by Petrie to be a native of S. Island, is actually on the market under the name of "Chewing's Fescue." What plant "of very little value as a sheep-grass" can Cockayne and Allan be referring to under the name "*F. rubra*"? There is more than a suspicion that they themselves are guilty of "dumping."

In spite of the discouragement by Cockayne and Allan of anyone abroad using the "herbarium method" in such an investigation, I venture to hope that the results here set forth represent a material advance in our knowledge of the New Zealand fescues. Purely for greater convenience in reference, I have followed the arrangement used by Hackel in his Monograph (1882), and kept to his method of denominating subspecies etc. where possible, whilst agreeing with Cheeseman etc. in the raising of these subspecies to species. It is unnecessary to rewrite diagnoses where satisfactory ones already exist, but I give emended diagnoses where the material warrants these, and feel fully justified in also diagnosing a new species as *F. Petriei*. I have been greatly tempted to include others, but have refrained on account of the material not being sufficiently confirmatory. I have submitted my views on these doubtful forms privately to Prof. Wall, who has the material.

I have very great pleasure in here recording my indebtedness to Dr. A. B. Rendle of the British Museum (Natural History) for so painstakingly revising my manuscript.

TEXT-FIG. 1.



Festuca ovina, vulgaris Hack.
Transverse section of radical leaf. × 90.

I. VULPIA Gmel.

FESTUCA SCIUROIDES Roth (=*F. bromoides* L.).

Hab. Near Greymouth, S. Island, 1888, Coll. R. Helms (*J. C. Melvill*).

II. EU-FESTUCA Griseb. (Ovinæ Fr., Hack.).

INTRAVAGINALES Hack.

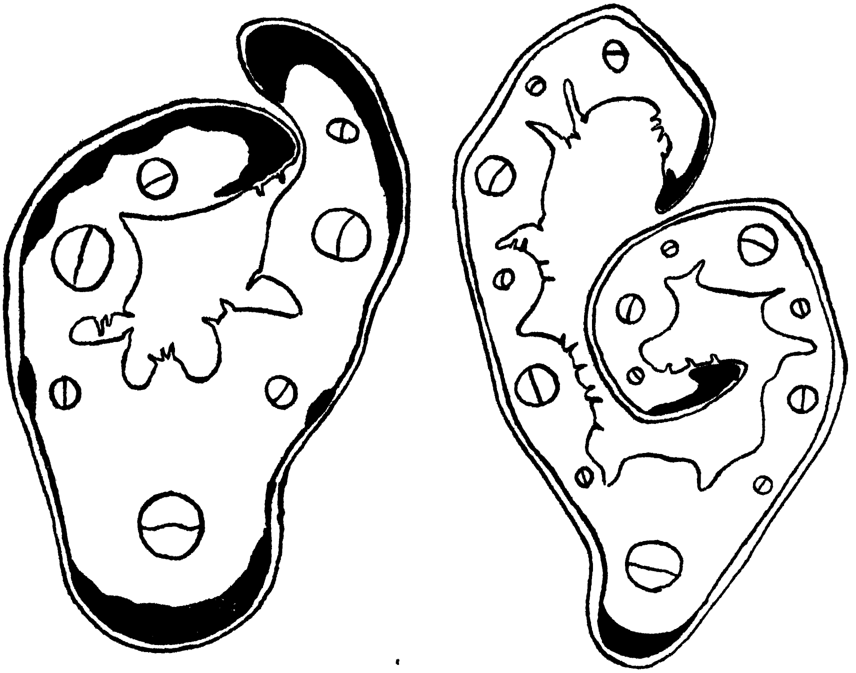
F. OVINA L. *sensu ampliss.* **Hack. subsp. EU-OVINA Hack. var. VULGARIS Hack.**

Hab. "The Mistake," junction of Forbes and Havelock Rivers, Upper Rangitata River, c. 3000 ft., *Wall*, No. 17 (trans. sect. radical leaf, text-fig. 1).

Var. DURIUSCULA Hack.

Hab. Hooker Valley, Mt. Cook, 3000 ft., Coll. Petrie (*Wall*, 133) (trans. sect. radical leaf, text-figs. 2 & 3).

TEXT-FIG. 2. TEXT-FIG. 3.



Festuca ovina, duriuscula Hack.

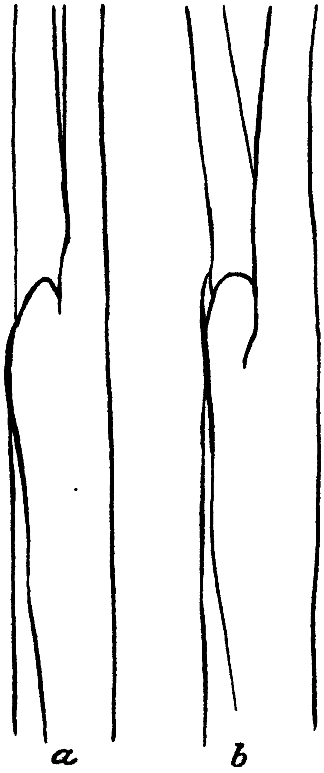
Figs. 2 & 3.—Transverse section of radical leaves. × 90.

Subsp. NOVÆ-ZELANDIÆ Hack. (1903, 384). Sp. NOVÆ-ZELANDIÆ Cheeseman (1925, 205 ; 1914, pl. 233).

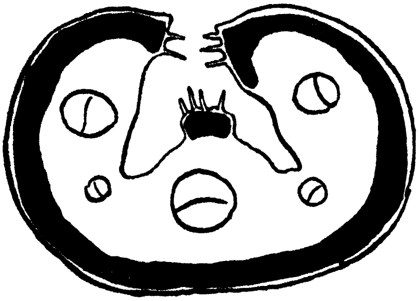
Descr. Culm 3·5 to 7·3 dm. high, erect, rigid, two to three nodes, of which the highest rarely stands more than halfway up the culm ; node covered by sheath of leaf below ; uppermost leaf shorter than its sheath ; culm scabrous below the panicle. *Leaves* all similar. *Sheaths* smooth or slightly rough, split to the base, sometimes pruinose just below the ligule especially when young. Sheath-auricles of ligule subacute or rounded, occasionally somewhat prolonged to 1 mm. or more in length (text-fig. 4 *a* & *b*), minutely ciliate on inner and upper edges, callus thickening absent. *Laminæ* cylindrical, rigid, varying in length from 20 to 40 cm., almost as long as the culms, glaucous-green, scabrous, sometimes pruinose, point usually acute, diameter in transverse section 0·4 to 0·7 mm., five vascular bundles, only one median ridge, a continuous stratum of sclerenchyma 2 to 3 cells thick below lower epidermis, margins strongly thickened and folded inwards (text-fig. 5). *Panicle* 9 to 26 cm. long, rather lax, contracted, lowest internode about one-third length of panicle ; axis, branches, and pedicels usually strongly scabrous and often pruinose; number of spikelets 13 to 43 per panicle. *Spikelets* elliptico- to ovato-lanceolate, 5 to 8 flowers, smooth to scabrous, often pruinose. *Glumes* sterile, more equal than in *F. ovina, Matthewsii,* roughly as 3 : 4, one- and three-nerved respectively, the longer one usually extending at least two-thirds up the fertile glume immediately above it, apex acute, minutely ciliate ; fertile, minutely scaberulous, lanceolate, 5·3 to 7·3 mm. long, awn usually absent or slight, occasionally to 2·6 mm. long, when it may be very slightly dorsal, nerves not distinct. *Pales* bifid, rough at apex and along keels. *Anthers* 3 mm. long. *Ovary* glabrous.

Hackel regards the nearest European ally as *F. ovina* subsp. *Beckeri* Hack. (1882, 100).

TEXT-FIG. 4.



TEXT-FIG. 5.



Festuca ovina, novæ-zelandiæ.

Figs. 4 *a* & *b*.—Auricles of radical leaves. × 9.
Fig. 5.—Transverse section of radical leaf. × 90.

Var. 1. EU-NOVÆ-ZELANDIÆ mihi.

Spiculæ —12 mm. longæ, glumæ fertiles —6·5 mm. longæ.

Hab. Mt. Herbert, in grassland up to 3000 ft. (*Wall*, 1, 5, 6) ; Cambrians, Central Otago, alt. 1200 ft. (*Wall*, 25); Southern Alps, Coll. T. Kirk, R. Helms (*J. C. Melvill*); Mt. Torlesse, Canterbury, 3000 ft. (*Cheeseman*); Mt. Potts, N. Canterbury Alps, *R. M. Laing legit D. Petrie* (Hb. Kew.).

Subvar. PRUINOSA mihi.

Spiculæ pruinosæ, folia innovationum plus minusve pruinosa.

The glumes, pedicels, and rachillæ of the spikelets are distinctly pruinose; the foliage is more or less pruinose.

Hab. Mt. Herbert, alt. 2000 ft. (*Wall*, 2); Port Hills, open grassland, 500 ft. upwards (*Wall*, 4); Hanmer Plains, dry, dominant form, c. 1500 ft. (*Wall*, 11); Mt. Hutt, 3000 to 4000 ft. (*Wall*, 20); Maniototo Plain, Eastern Otago, 1400 ft. (*Wall*, 132).

Var. 2. GRANDIFLORA mihi.

Spiculæ magnæ, 12 mm. et ultra longæ; glumæ fertiles 6·3–7·0 mm. longæ.

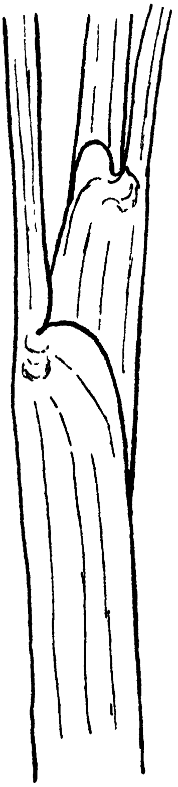
Hab. Mt. Herbert, grassland, 2500 ft. (*Wall*, 4).

" Grown by Dr. Petrie in his garden at Auckland from plant at Sumner Road, Lyttelton" (*Wall*, 8).

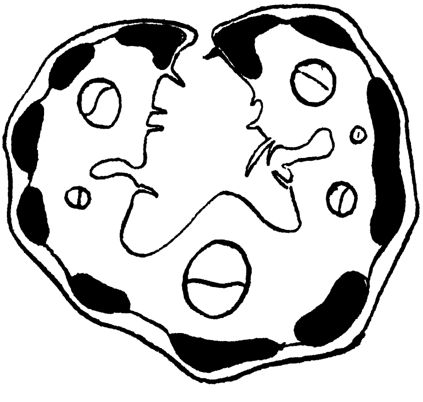
Subsp. MATTHEWSII Hack. (1903, 385). Sp. *Matthewsii* Cheeseman (1925, 205).

Descr. Culm 3·5 to 6 dm. high, rigid, two to three nodes, the highest rarely more than one-fourth to one-third height of culm; nodes covered by sheath of leaf below; naked upper portion of culm smooth, rarely scabrid just below panicle. *Leaves* somewhat dissimilar. *Sheaths* rather loose, smooth, split to the base, may be pruinose about the ligule, especially when young. Sheath-auricles of ligule usually rounded, minutely ciliate all round or on inner margin only (text-fig. 6). The older leaves show a prominent callus-like thickening near the ligule, and the lamina may ultimately break off just above this. *Laminæ* of radical leaves varying in length from 11 to 60 cm., sometimes reaching almost to the summit of the panicle; somewhat rigid, smooth, glaucous-green, sometimes pruinose, tip varying from acute to subobtuse, in transverse section obtuse-hexagonal to rounded, 0·4 to 0·8 mm. diameter, five vascular bundles, sclerenchyma in a discontinuous layer or in distinct strands just below the vascular bundles and at the margins, the upper surface with one, three, or five ridges, the lateral ones subdistinct (text-fig. 7); of culm leaves in t.s. about eleven vascular bundles, some corresponding to the usually five main ridges, others alternating or forming sub-distinct intermediate ridges, sclerenchyma in separate strands below all v.b.'s and sometimes neighbouring strands confluent (text-fig. 8). *Panicle* 9 to 14 cm. long, loose, spreading at anthesis, lowest internode one-third to one-half the length of axis, branches and pedicels roughish along the margins or all over. *Spikelets* 6 to 33 per panicle, elliptico- to ovato-lanceolate (text-fig. 9), 9 to 18 mm. long, 4 to 8 flowers (including rudimentary terminal one). *Glumes* usually smooth and pruinose, occasionally slightly rough; sterile, unequal, roughly as 2 : 3, one- and three-nerved respectively, the second covering one-half to two-thirds, fertile glume immediately above it, apex somewhat rounded (or muticous) and minutely ciliate; fertile, linear to lanceolate, broadest below middle and gently narrowing to terminal awn, 5·7 to 8·0 long, awn 1·4 to 2·8 mm. long. *Pale* with bifid apex, rough at tip and along keels. *Ovary* glabrous, styles terminal. Grain with hilum about half its length, crescentic in t.s.

TEXT-FIG. 6.



TEXT-FIG. 7.



Festuca ovina, Matthewsii.

Fig. 6.—Auricles of radical leaves. × 12.
Fig. 7.—Transverse section of radical leaf. × 90.

Hackel places it near the European sp. *F. ampla* Hack. (1882, 125) and the Asiatic sp. *F. nubigense* Jungh.

Var. 1. EU-MATTHEWSII mihi. (Text-fig. 21.)

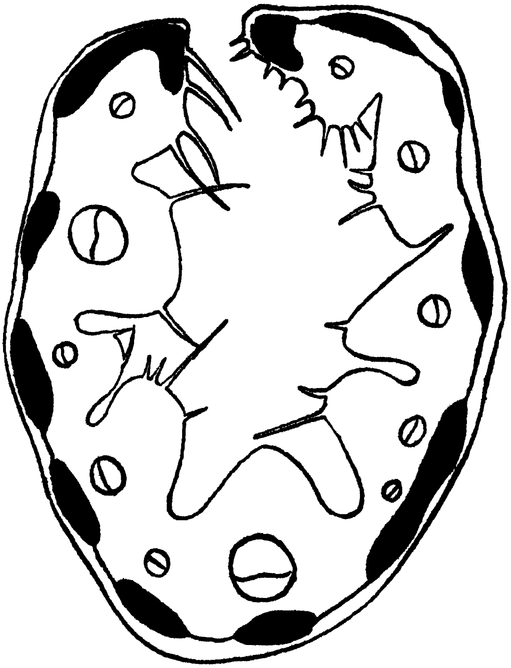
Culmi 3·5 to 4·0 dm. alti. Laminæ innovationum 0·6–0·7 mm. diam. **Panicula 8·5–13 mm. long., spiculæ 9–12 mm. long., glumæ fertiles —6·5 mm.**

long., breviter aristatæ. Vaginæ et laminæ semper plus minusve pruinosæ, et spiculæ plerumque pruinosæ.

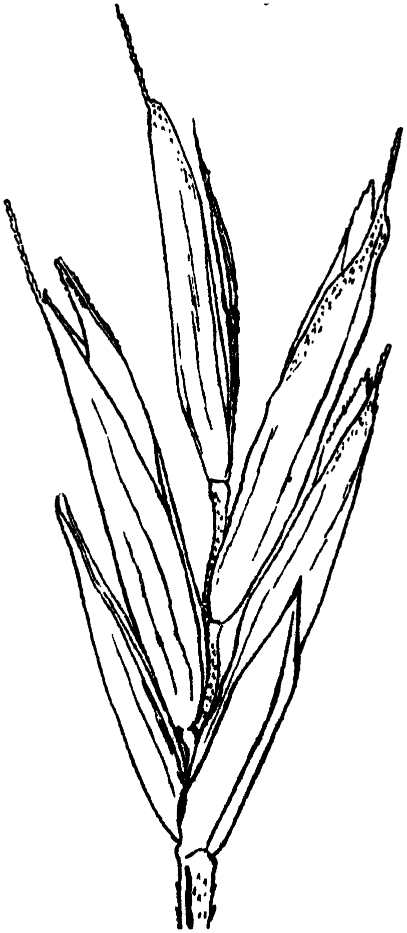
The tips of the leaves reach to about three-fourths the height of the panicle. The number of spikelets per panicle varies from 6 to 24, each bearing 4–5 flowers. The awns of the fertile glumes are 1·4–1·7 mm. long.

Hab. Diamond Harbour, Lyttelton Harbour, near Christchurch, among rocks at sea-level (*Wall*, 3, 2 sheets).

TEXT-FIG. 8.



TEXT-FIG. 9.



Festuca ovina, Matthewsii.
Fig. 8.—Transverse section of culm leaf. × 90.
Fig. 9.—Spikelet. × 12.

Var. 2. GRANDIFLORA mihi.

Culmi 4·5–6·0 dm. alti. Laminæ innovationum 0·5–0·6 mm. diam. Panicula major, 12–14 cm. long., spiculæ majores, 13–18 mm. long., glumæ fertiles 6·5–8·0 mm. long., aristæ 1·4–2·8 mm. long.

The tips of the leaves reach to about half the height of the culm. The number of spikelets per panicle varies from 11 to 29, each bearing 7 to 9 flowers.

Hab. Lyttelton and Port Hills, about sea-level (*Wall*, 7 & 9, Herb. Kew., *Petrie*, × 2); Freeman River, Otago, *J. Crosby Smith leg.* (Herb. Kew., *Petrie*, × 3).

EXTRAVAGINALES OR MIXTÆ Hack.

F. RUBRA L., *sensu ampliss.*, Hack. subsp. EU-RUBRA Hack. var. GENUINA Hack. subvar. VULGARIS Hack.

Hab. Pudding Hill Stream, Mt. Hutt, edge of bush, c. 7000 ft. (*Wall*, 12); Murderer's Creek, Broken River, Upper Waimakariri, c. 3000 ft. (*Wall*, 16, doubtful, as represented by two culms only with panicles); Western branch of Hawdon River, *i.e.*, North branch of Waimakariri River, near Christchurch (culm and panicle only, *Wall*, 18; Herb. Kew., leg. *Wall*); Mt. Rolleston, on Waimakariri River, 3000 to 4000 ft. (*Wall*, 19, also Herb. Kew., Arthur's Pass, same district, *Petrie*, × 16); Mt. Herbert, Banks Peninsula, 2500 to 3000 ft. (*Wall*, 19); Mt. Bernard, on Waimakariri River, c. 4000 ft. (*Wall*, 19); Hanmer Mts., S.E. Nelson, *leg. Wall* (Herb. Kew.); Mt. Ida, Maniototo Co., Otago, *leg. B. C. Aston* (Herb. Kew.); Motucka Valley, *D. Munro* (Herb. Kew.); Rotuita Lake, Aglionby Plains, *D. Monro* (Herb. Kew.); Mt. Miro Miro, S. Marlborough, S. Island, c. 4000 ft., *Petrie* (doubtful); Signal Hill, near Dunedin, c. 1500 ft., widely spread in damp or semi-boggy situations, "appears to be indigenous," *Petrie* (Herb. Kew.); Clarence Valley, higher part, Marlborough, *B. C. Aston leg.* (Herb. Kew., *Petrie*, × 12).

Subvar. ARENARIA Hack.

Hab. East coast, N. Island, 12th March, 1925 (*A. Wall*).

Var. FALLAX Hack. (var. *commutata* Gaud.).

Hab. Craigieburn Range, c. 4000 ft. (*Wall*, 23); grown from plants from Hooker Valley, Mt. Cook, hort. *Petrie* (*Wall*, 24, Herb. Kew., *Petrie*, × 4, and another sheet); uplands about Fairfield, near Dunedin, *Dr. Lauder Lindsay* (named "*duriuscula*" by Hooker, Herb. Kew.); Waikato River, "commonly cultivated as Chewing's Fescue, and thought to be a native of S. Island" (Herb. Kew., *Petrie*, × 8); Waimakariri River, N. Canterbury, *leg. A. Wall* (Herb. Kew.); near Naseby, Maniototo Co., Otago, c. 1800 ft. (Herb. Kew., *Petrie*, × 13).

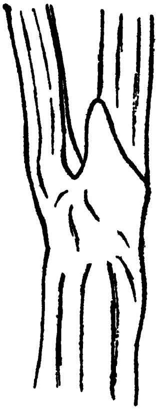
The two last mentioned in the above list are referred to *F. dura* Host by Dr. Stapf, and no doubt account for Petrie's statement (1920). The sheaths of the radical leaves are entire however, and the innovations show transitional leaves between the small prophyll and normal vegetative ones. Hence I refer them to Extravaginales Hack. under sp. *F. rubra* L., *sensu ampliss.*, Hack.

F. Petriei, sp. n. (Text-fig. 23.)

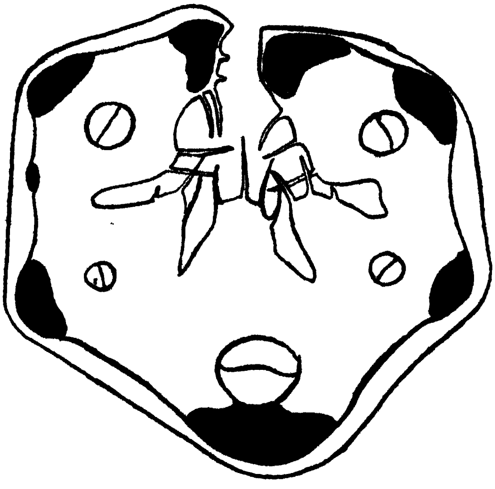
Char. Vaginæ fere ad basin usque fissæ ; ligulæ glabræ vel minutissimæ ciliolatæ, auriculæ prominentes.

Descr. Laxe vel plus minusve dense cæspitosa. *Innovationes* extravaginales longo repentes. *Culmi* 4·0–6·5 dm. alti, læves, trinodes, nodo summo in $\frac{1}{4}$–$\frac{2}{5}$ culmo sito. *Vaginæ* foliorum innovationum ima basi tantum integræ, ceterum fissæ. *Ligulæ* biauriculatæ, auriculæ protractæ ultra 1 mm. *Laminæ* subconformes; innovationum 30–40 cm. long., læves, apice acutiusculæ ; complicatæ, trans. sect. hexagonæ, 0·7 mm. diam., 5-nervis, 5-costatæ, fasciculis sclerenchymaticis 5–7 discretis instructæ. *Panicula* 9–28 mm. long., laxiuscula, anthesi patens, apice sæpe nutans, ramis inferioribus geminis, ramo primario panicula dimidia breviore. *Spiculæ* lanceolatæ, 9–12 mm. long., sæpius 3–7-floræ. *Glumæ steriles* inæqualibus; Imæ lineari-lanceolatæ, 1-nervis, 3–4 mm. long., IIdæ acutæ, 3-nervis, 4–5·3 mm. long., ad $\frac{1}{2}$ IVæ pertinens. *Glumæ fertiles* lanceolatæ, 6·0–7·2 mm. long., aristæ −2·3 mm. long., apice subintegro, arista subapicali vel apicali. *Palea* apice bidenticulata, ciliata. *Antheræ* 2–3 mm. long. *Ovarium* apice parce hispidulum.

Text-fig. 10.



Text-fig. 11.



Festuca Petriei.

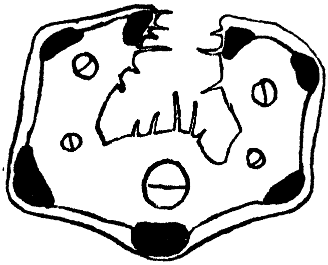
Fig. 10.—Auricles of radical leaf, × 12.

Fig. 11.—Transverse section of radical leaf. × 90.

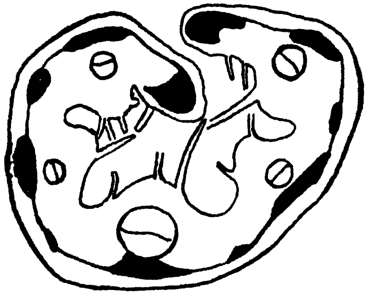
The stock spreads rapidly by means of numerous fine stolons. The culms stand 4·0 to 6·5 dm. high, their highest nodes about one-fourth to two-fifths this height, the three nodes are enclosed in the sheaths of the leaves below, the naked upper portion of the culm is smooth. The leaves are all similar. *Sheath* smooth, open to the base. *Ligule* auricled, auricles either

prolonged to 1 mm. or more or shorter on one side, rather ciliate, a slight callus is also present but not so prominent as in *F. Matthewsii* (text-fig. 10). *Laminæ* 11–40 cm. long, smooth, tip acute, always quite flat in the fresh condition, in t.s. 0·7 mm. diam. when folded (0·4 mm. in forma *tenuifolia*, text-fig. 12 *a*), five vascular bundles, five to seven sclerenchymatous strands, of which the median one may be joined to the median bundle, shape obtuse-hexagonal (text-fig. 11, radical leaf; text-fig. 13, culm leaf). *Panicle* 9–28 cm. long, slender, nodding, open at anthesis, axis almost smooth, branches slightly rough, lowest branch about one-half the length of the panicle.

Text-fig. 12 *a*.



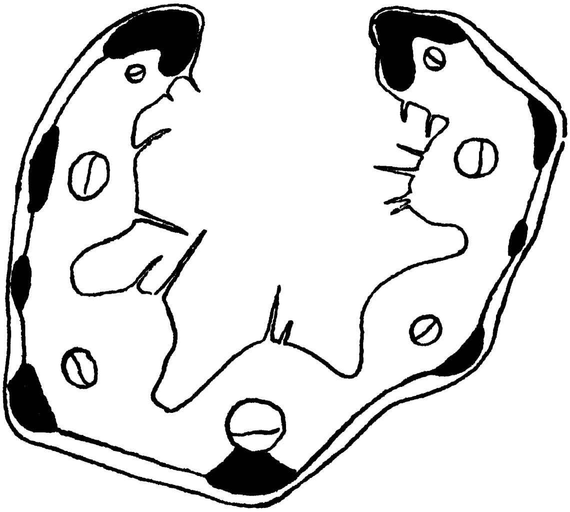
Text-fig. 12 *b*.



Festuca Petriei forma *tenuifolia*.

Fig. 12 *a*.—Transverse section of radical leaf. × 90.
Fig. 12 *b*.—Transverse section of culm leaf. × 90.

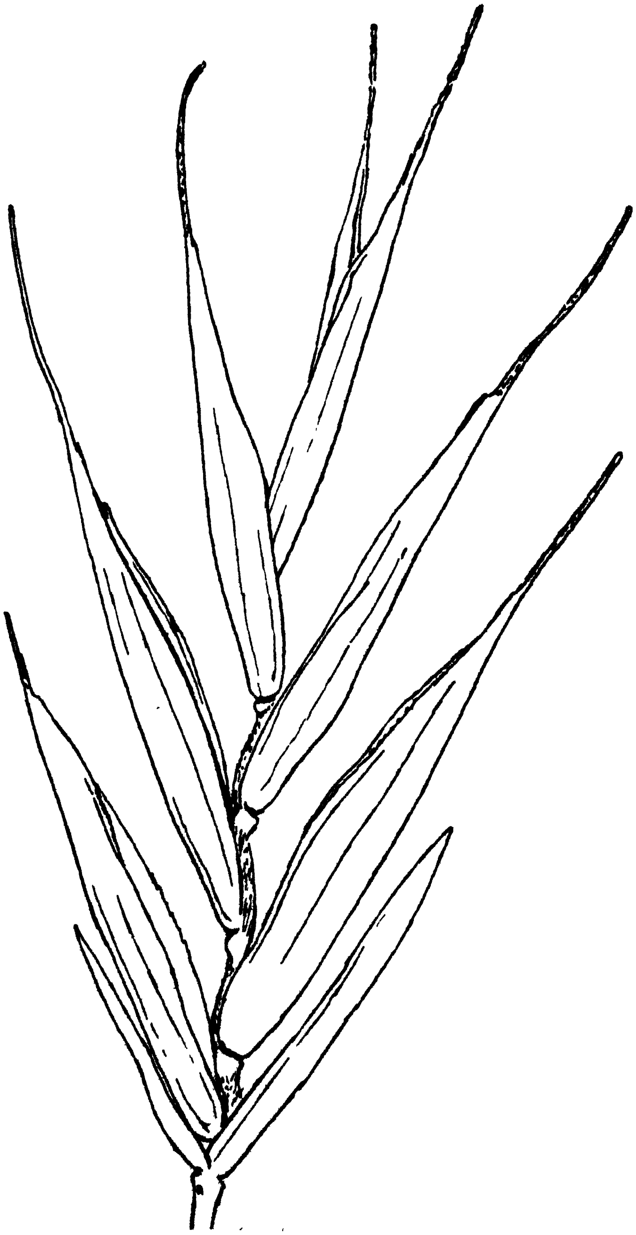
Text-fig. 13.



Festuca Petriei.

Transverse section of culm leaf. × 90.

TEXT-FIG. 14.



Festuca Petriei. Spikelet. × 12.

Spikelets, 16–30 per panicle, lanceolate, 10·5–12 mm. long, bearing three to seven flowers (text-fig. 14). *Glumes* sterile, unequal, I. narrow, acute, one-nerved, 3·0–3·9 mm. long, about half the length of II.; latter acute, three-nerved, 4·0–5·9 mm. long, extending about halfway up IV.; fertile, lanceolate, smooth except perhaps at the tip where slightly scabrid, more or less pruinose, tip may project very slightly as two minute points beyond base of awn, 6·0–7·2 mm. long; awns to 3·4 mm. long; palea bifid, strongly ciliate at tip and along keels, appears at first to grow more slowly than its glume, and so in younger flowers is only one-half to two-thirds its length. *Anthers* 2–3 mm. long. *Ovary* has a number of stiff sharp hairs about the bases of the stigmas; caryopsis with linear hilum about half its length in a shallow concavity. Petrie says this plant has great economic possibilities.

A slender-leaved form which Petrie regarded as belonging to *F. novæ-zelandiæ* corresponds in all other respects to *F. Petriei.* Careful breeding is necessary for certainty, but from the available evidence I describe it as: forma *tenuifolia* mihi.

Folia innovationum 0·4 mm. diameter (trans. sect. rad. leaf, fig. 12*a*; culm leaf, 12*b*). Lyttelton, Sumner Rd. (*Wall* 8).

Hab. of type near Hermitage, Tasman Valley, Mt. Cook, at altitudes round 3,200 to 3,300 ft., coll. Petrie (*Wall,* nos. 131, 141, 142; also Herb. Kew.).

In Hackel's system, *F. Petriei* belongs to the Ovinæ, subsection Extravaginales, but differs from *F. rubra* in its split sheaths. The only other European species in this subsection is *F. Porcii* Hack., with which there is some correspondence in both sheath and ovary characters.

F. MULTINODIS Petrie & Hack. (1912, 186); Cheeseman (1925, 206).

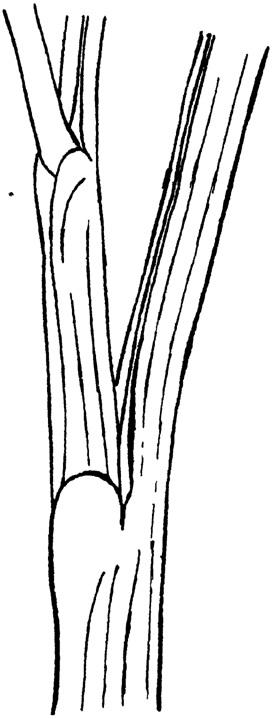
The plant is more or less tufted at the base, but the various branches become prostrate in their lower parts, and finally erect. Branches arising from these are mostly extravaginal, but on the more elongated leafy shoots some higher branches may be intravaginal. The previous descriptions do not mention this. Another character which has not been noted is that the ovary has a few stiff sharp hairs about the bases of the styles.

The general habit of the plant is shown by text-fig. 21, the ligule-auricles in text-fig. 15, the transverse sections of radical and culm leaves in text-figs. 16 & 17, and the spikelet in text-fig. 18.

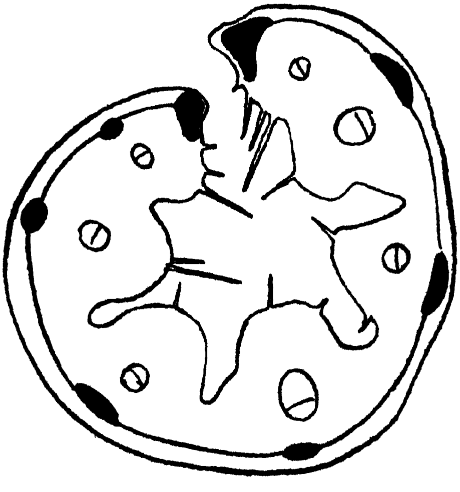
This plant is evidently associated in the same group with *F. Petriei* and *F. Porcii* in the subsection Extravaginales of Ovinæ. Hackel points out the distinctions between *F. multinodis* and *F. rubra,* but I think overemphasises the innovation character.

Hab. Seatown, Wellington, "type-locality," *Petrie* (*Wall,* 15); Manawatu Gorge, North Island (*Wall,* 15 *b*); coast-cliffs near Wellington, coll. *H. H. Travers, B. C. Aston, D. Petrie*; and Day's Bay, near Wellington, coll.

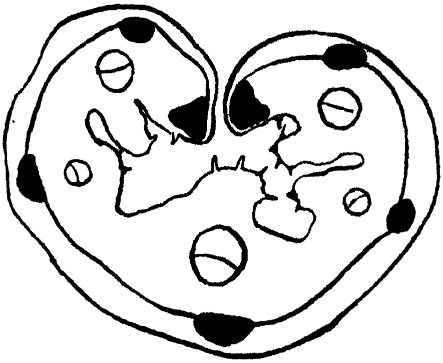
Text-fig. 15.



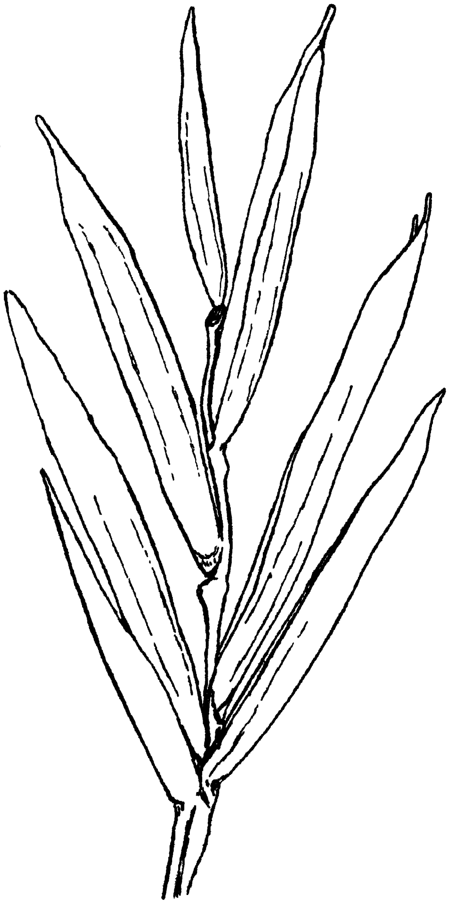
Text-fig. 17.



Text-fig. 16.



Text-fig. 18.

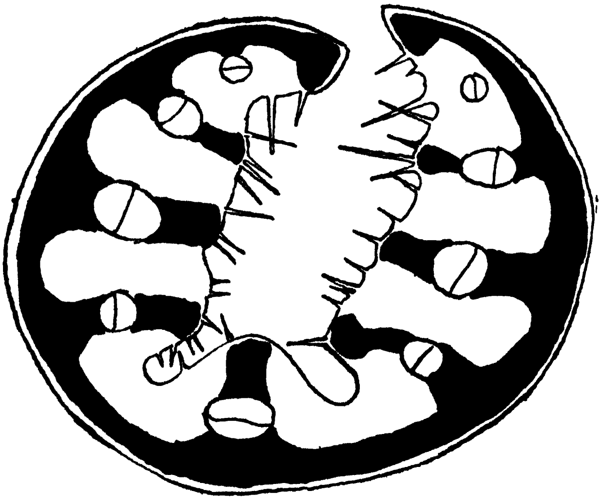


Festuca multinodis.

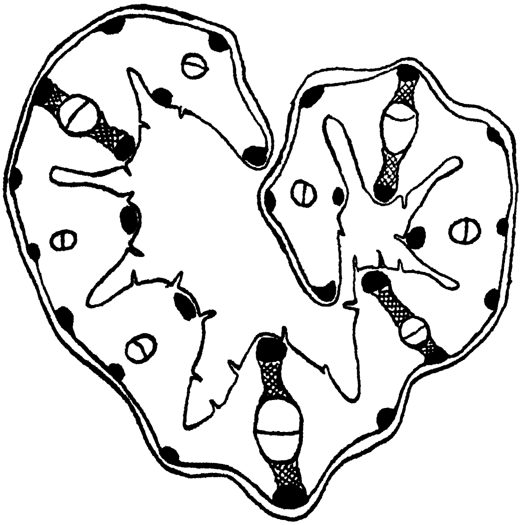
Fig. 15.—Auricles of radical leaves. × 12.
Fig. 16.—Transverse section of radical leaf. × 90.
Fig. 17.—Transverse section of culm leaf. × 90.
Fig. 18.—Spikelet. × 12.

B. C. Aston (*Wall*, 137) ; Amuri, N.Z., *Hector* ; Cook St., North Island, under "*F. duriuscula*, lowland form," *T. Kirk*, both in Herb. Mus. Brit. ;

TEXT-FIG. 19.



TEXT-FIG. 20.



Festuca littoralis Labill.

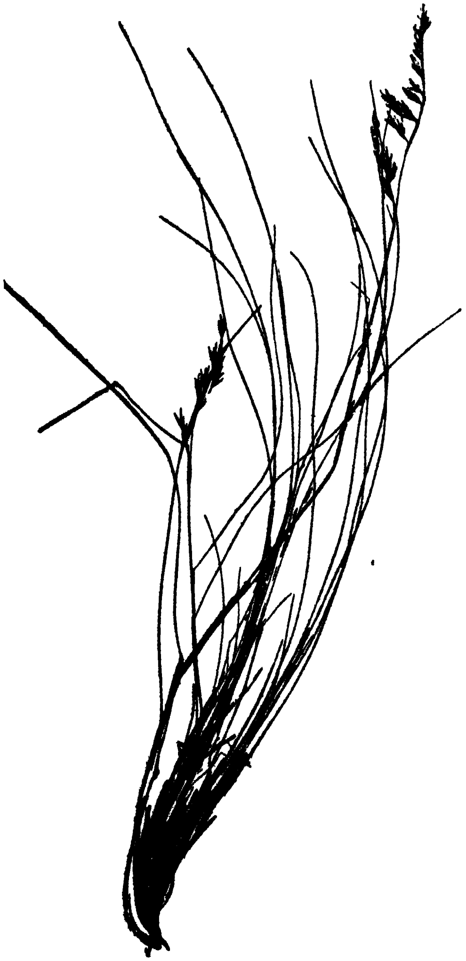
Fig. 19.—Transverse section of radical leaf. × 90.
Fig. 20.—A probable new form under Schedonorus. Transverse section of radical leaf. × 90

Cook St., near Wellington, *B. C. Aston* (Herb. Kew.). ; Port Nicholson, North Island, *T. Kirk*, *J. Cosmo Melvill*.

There are some other forms which undoubtedly belong to the section Ovinæ Hack., but whose exact position in this section I cannot conclusively prove on account of the rather limited material.

(1) *Hab.* Campbell Island, *coll. B. C. Aston, Petrie*, no. × 14, Herb. Kew.

TEXT-FIG. 21.



TEXT-FIG. 22.

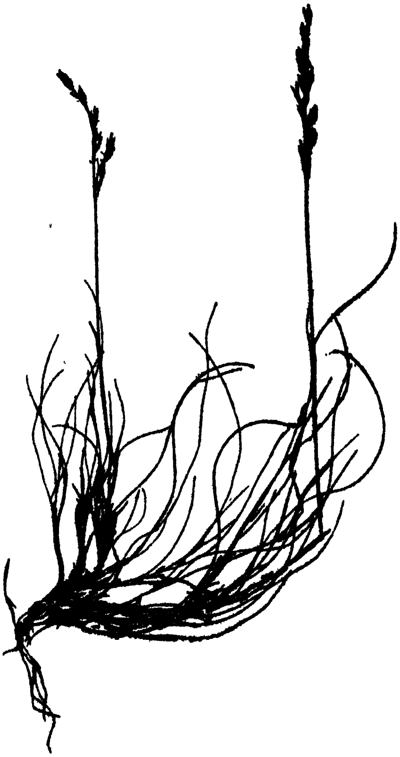
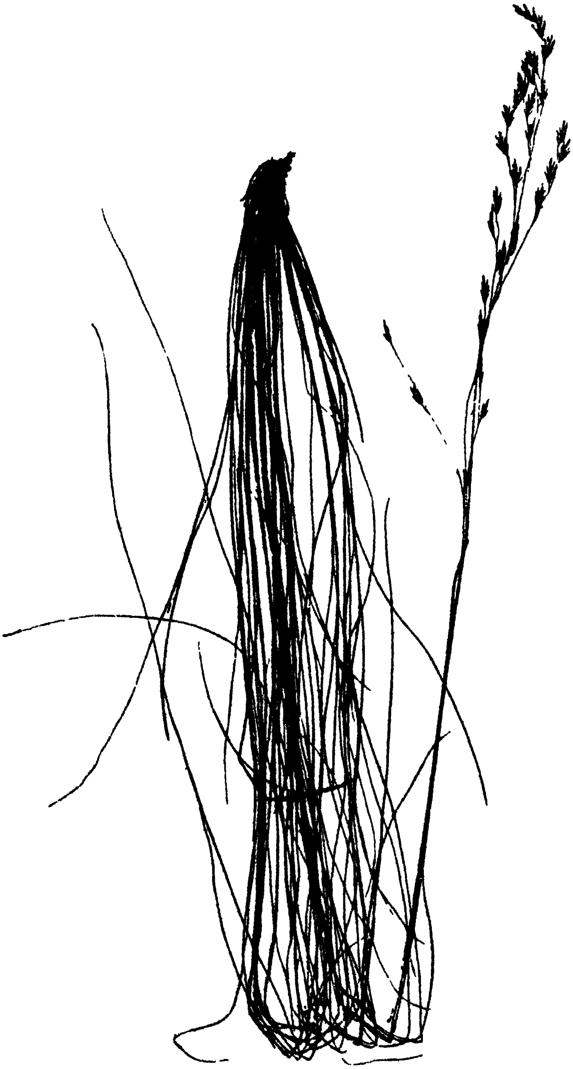


Fig. 21.—*Festuca ovina* Hack. subsp. *Matthewsii* Hack. var. *eu-Matthewsii*. Plant one-third nat. size.

Fig. 22.—*Festuca multinodis* Hack. & Petrie. Plant one-third nat. size.

The material does not show any extravaginal innovations, and the sheaths of the radical leaves are entire to more than halfway from their base; the anthers are less than 1 mm. long. I consider that the plant is near *F. ovina* subsp. *brevifolia* Hack., and have compared it with the type-specimen of R. Brown in the British Museum Herbarium, but find that it differs in several important characters. On account of uncertainty as to the innovation characters, I feel that it needs further investigation before it can be described as a new species and relegated to a position in the scheme of classification.

TEXT-FIG. 23.



Festuca Petriei, sp. n. Plant one-third nat. size.

(2) *Hab.* Mineral Belt, Nelson, northern end of North Island, c. 2000 ft. (*Wall*, 19); Mt. Clenghearn, Fiord Co., S. Island, *leg. J. Crosby Smith*, *Petrie*, no. × 9, Herb. Kew.; Mt. Fyffe, S. Marlborough, *coll. L. Cockayne*, sent by Petrie to Kew. Dr. Stapf reports "*F. rubra* forma."

I am inclined to place these three gatherings under *F. rubra* subsp. *violacea* Hack.

(3) *Hab.* Richmond Range, Two Thumbs, near the Rangitata River, South Island, quite abundant from about 4000 to 6000 ft. Flowers very late. *Coll. Wall*, no. 21, Herb. Kew., *Petrie*, × 11. This appears to belong to *F. rubra* subsp. *eu-rubra* var. *fallax* Hack.

III. SCHEDONORUS Beauv.

Festuca littoralis Labill. (1804, p. 22, pl. 27) is described and figured by Buchanan (1880, p. 155, pl. liv.), and described by Cheeseman (1925, 205). It is so named also by R. Brown (1823, 816) and by F. von Mueller (1882, 134). Under *Schedonorus littoralis* it is found in Raoul (1846, 39); Hooker (1864, 341); Rodway (1903, 271). According to Buchanan (*loc. cit.*) the larger form var. *triticoides* Bentham (1863–70) is more common on the coasts of New Zealand.

In text-fig. 19 I give a transverse section of the radical lamina.

Specimens have been examined as follows:—Island Bay, Wellington, N. Island (*Wall*); Banks Peninsula, S. Island (*T. Kirk*), Herb. Mus. Brit. Three sheets in Herb. Mus. Brit., no definite locality stated: (*a*) coll. Lyall, ex Herb. Hooker; (*b*) N. Island, *A. Sinclair*; (*c*) *coll. W. Stephenson*, 1843–44.

Pegasus Bay, *coll. J. H. Armstrong*, *R. Helms* (*J. C. Melvill*); Great Omaha, *coll. R. Helms*, *T. Kirk* (*J. C. Melvill*).

SUMMARY.

The list of forms of *Festuca* occurring in New Zealand now comprises:

I. **Vulpia** Gmel.

F. sciuroides Roth.

II. **Eu-Festuca** Griseb.

§ INTRAVAGINALES **Hack.**

F. ovina, eu-ovina, vulgaris Hack.
„ „ ***duriuscula*** **Hack.**
„ ***novæ-zelandiæ*** **Cock. var.** ***eu-novæ-zelandiæ*** **mihi.**
„ „ **var.** ***pruinosa*** **mihi.**
„ ***Matthewsii*** **Cheesem. var.** ***eu-Matthewsii*** **mihi.**
„ „ **var.** ***grandiflora*** **mihi.**

§§ EXTRAVAGINALES or MIXTÆ Hack.

F. rubra, violacea Hack.

„ *eu-rubra* Hack. var. *genuina* Hack. subvar. *vulgaris* Hack.

„ „ „ subvar. *arenaria* Hack.

„ „ var. *fallax* Hack. (*commutata* Gaud.).

F. Petriei mihi, sp. n.

F. multinodis Hack. et Petrie.

III. **Schedonorus** Beauv.

F. littoralis Labill.

In addition, there are apparently rare *F. erecta* D'Urv. and *F. Coxii* Hack., and probable new types under II. (Intravaginales) and III. Cockayne (1919, ed. 2, p. 153) mentions *F. arundinacea*, which comes under III.

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The Herbal of Otto Brunfels.

By T. A. SPRAGUE, B.Sc., F.L.S.

[Read 3rd November, 1927.]

THE herbal of Otto Brunfels forms a link between ancient and modern botany, and may be regarded either as the end of the long line of classical and mediæval works on medicinal plants or as the beginning of modern taxonomy. The real renascence of botanical science began in the sixteenth century, when the study of living plants gradually replaced the study of what had been written about them by classical authors, and the mediæval period in botany may therefore be considered as extending to the end of the fifteenth century. The text of Brunfels was virtually a compilation of the dicta of his predecessors, and in this respect his work is purely mediæval in character. The provision of life-like wood-engravings of living plants, however, makes it possible, for the first time in history, to identify a high percentage of the species concerned, so that modern systematic botany may almost be said to start with Brunfels.

1. *Previous Identifications of his Plants.*

Various authors from Caspar Bauhin (4) onwards have supplied identifications of many of the plants described or figured in Brunfels's herbal, but no complete list has ever been published, and the most comprehensive one, that of Moretti (32), contains numerous identifications that are demonstrably incorrect. The first volume of Brunfels's herbal was published in 1530 under the title 'Herbarum Vivæ Eicones,' and was followed by a second in 1531, and a third issued posthumously in 1536. All these were in Latin, and passed through several editions. A German edition appeared in 1532 under the title 'Contrafayt Kreüterbuoch,' and a second volume of it was published posthumously in 1537. These included nearly all the figures of the Latin version, and over fifty additional ones. Altogether about 260 species were figured by Brunfels.

Less than a century later the number of known plants had increased so enormously, and such an extensive synonymy had grown up, that the coordination of existing nomenclature became an imperative necessity. The gigantic task was undertaken by Caspar Bauhin, whose 'Pinax Theatri Botanici' (1623) contains the accepted names and synonyms of about six thousand species. About 80 per cent. of the figures in Brunfels were correctly identified by Bauhin, whose 'Pinax' remains an indispensable key to the herbals of the sixteenth century. Most of the corresponding Linnean names may be found by reference to Richter's 'Codex,' as the names in the 'Pinax' were, with relatively few exceptions, cited by Linné in the 'Species Plantarum.'

The next important contribution to the study of Brunfels's plants was made by Kurt Sprengel, who included a short list of identifications in his 'Historia Rei Herbariæ' (1808), and a longer one, containing 131 names, in his 'Geschichte der Botanik' (1817). In 1852 Moretti (**32**) supplied determinations of all the plants figured in the three volumes of the Latin version. Finally, an authoritative list of 106 species figured in the first two volumes of the herbal was given in Kirschleger's 'Flore d'Alsace,' vol. ii (1857). Over twenty of the determinations given by Sprengel (**39**) appear to be incorrect, and about twenty-five of those of Moretti. A few of the more obvious misidentifications of Brunfels's figures may be mentioned. Caspar Bauhin treated *Chamæpitys* Brunf. (*Veronica Teucrium* L.) as a synonym of his *Chamædrys minor repens* (*Teucrium Chamædrys* L.); and cited *Buglossa sylvestris* Brunf. (*Echium vulgare* L.) under his *Buglossum sylvestre minus* (*Lycopsis arvensis* L.). *Uvularia mas* and *Uvularia fœmina* Brunf., which Bauhin had referred correctly to his *Laurus Alexandrina fructu pediculo insidente* (*Ruscus Hypoglossum* L.), were misidentified by Sprengel as *Uvularia amplexifolia* L. (*Streptopus amplexifolius* Lam. et DC.). Moretti went still further astray, identifying *Uvularia mas* as *Streptopus amplexifolius* and *Uvularia fœmina* as *Convallaria latifolia* Jacq. (*Polygonatum latifolium* Desf.).

One of the chief difficulties attending the identification of Brunfels's figures is the absence of anything approaching a botanical description, while another is the circumstance—noted already in 1542 by Fuchs (**18**)—that the figures do not always correspond with the accompanying text. Some striking examples are *Erodium cicutarium* L., figured as *Herba Roperti* (*Geranium Robertianum* L.), *Trifolium pratense* L., figured as *Brunella* (*Brunella vulgaris* L., *Isnardia palustris* L., which is associated with the text of Burtzelkraut (*Portulaca oleracea* L.), and *Atropa Belladonna* L., which purports to represent Encian (*Gentiana lutea* L.). How far Brunfels was responsible for the last three misidentifications is uncertain, as they appeared in posthumously issued volumes. It is inconceivable that he could have confused Cress (*Lepidium sativum* L.) with Rice (*Oryza sativa* L.), but a figure of the former is associated with text of the latter in the second part of the 'Contrafayt Kreüterbuoch.'

2. *Life of Brunfels.*

The key to these various inconsistencies is to be found in a consideration of the career of Brunfels, and in an intensive study of his herbal.

Sprengel (38, 39), Meyer (30), F. W. E. Roth (36), Greene (20), Arber (2), and others have dealt more or less exhaustively with the life of Brunfels, so that here only such facts as bear on his attainments as a botanist need be mentioned. As far as biographical details are concerned, Roth's paper is the most complete, and where these authors differ as to dates, etc., his account has been accepted. His botanical identifications, on the other hand, are not very helpful, examples being *Senecio vulgaris* L. identified as "*Gnaphalium arvense* Willd.," *Lepidium sativum* L. as "*Nasturtium officinale,*" and *Leonurus Cardiaca* L. as "*Lycopus europæus.*"

Brunfels was born in 1489 at Mainz, where he received a good education, taking the degree of M.A. at the age of 20 or 21. Subsequently he entered the Carthusian monastery at Strasburg and remained there until 1521, when, having become a Protestant, he escaped from the monastery and fled to Ebernburg bei Kreuznach. After three years spent at various places in south-west Germany, as an evangelical pastor and theological writer, he returned to Strasburg in 1524, and established a school there, marrying in the same year. While still in the Carthusian monastery he had written on education and theology, and from 1524 onwards, without forsaking these subjects, he applied himself to the study of medicine and botany, preparing new editions of two works on medicine and surgery in 1524 and 1528 respectively, and completing his 'Catalogus illustrium medicorum' in 1529.

His first botanical publication was the 'Herbarum Vivæ Eicones,' which appeared in 1530. During the next four years, in addition to preparing the second and third volumes of his herbal, and the German edition of it, he published several works on medicine and pharmacy, including his 'Onomastikon medicinæ' (1534). He obtained the degree of M.D. at the University of Basel in 1532 or 1533, and, after a short period of private practice as a physician at Strasburg, was appointed in 1533 Town Physician of Bern, where he died in 1534.

3. *Preparation of the Herbal.*

A study of his herbal leads to the conclusion that—at all events, in the first volume—the greater part of the text was prepared first, living specimens being obtained subsequently for the purpose of illustration. Thus in the first volume of the Latin version (1530) the chapters on *Linaria* (p. 193), *Esula* (p. 194), *Malvæ* (p. 197), *Catapucia* (p. 230), *Chamæmelum* (p. 252), and *Parietaria* (p. 263) are unillustrated; and no figure of the true *Mercurialis* (p. 261) is given, though there is one of Guot Heynrich, which some of Brunfels's contemporaries considered to be a second kind of *Mercurialis*. Illustrations of the three species of *Malva* and of *Parietaria* were supplied subsequently in vol. ii (1531), while *Esula* and *Chamæmelum* were figured in the 'Contrafayt Kreüterbuoch' (1532). In the Preface to the latter work (Cap. xxxii) he explains that some of the figures were not ready in time to be included.

In some cases Brunfels himself recognized a lack of correspondence between the classical plants and those which he figured. Thus under *Arona* [sic] * he pointed out that the species illustrated was shown to him as *Aron* by the herbalists, but that it did not agree in all respects with the description of the classical plant of that name. Similarly, after a long account of *Colubrina* (*Serpentaria*, *Viperina*, *Dracunculus*, *Dracontium*) he mentioned (p. 68) that confusion had crept in as to the identity of the classical plants, and that the herbalists and old women had shown him many different kinds of *Serpentaria*, only two of which he thought worth figuring. Brunfels refers repeatedly to the opinions of the herbalists, most of whom he classes among the "vulgus" (i, 81, 135) as opposed to the "docti" (classical scholars), while paying a tribute to their practical knowledge of plants: "qui non ex libris sapiebant, sed experientia rerum edocti erant." The only herbalist whom he cites by name is Hieronymus Tragus (Jerome Bock), whom he calls Hieronymus Herbarius. He held Tragus in deservedly high esteem, sometimes styling him "Nobilis Experimentator et Herbarius" (i, 55), "Nobilis Empiricus" (i, 110), "Nobilis Herbarius" (i, 74, 81), or "doctissimus vir" (iii, 15, sub voce *Scolopendrion*).

Brunfels appears to have accepted the names of plants generally current in the fifteenth and early sixteenth centuries ("verum plus secutus sim vulgi opinionem, doctorumque hominum," iii, 10; "vulgatam nomenclaturam Herbariorum imitatus," iii, 11), rarely—as in the case of *Narcissus* (i, 135)—venturing upon an independent identification of his own. Like other botanical writers of his times he sought information from all sources, including the old women, who possessed a knowledge of herbs ("vetulas expertissimas," iii, 13, sub voce *Eufragia*). It was they who persuaded him to give a picture of Guot Heinrich: "Præterea et eam adpinximus quæ vulgo Guot Heinrich vocatur, vel Schwerbel. Ita enim vetulæ nos persuaserunt" (i, 68). His distinguished contemporary, Euricius Cordus, also learned much from the old peasant women whom he encountered on botanical excursions into the country ('Botanologicon,' pp. 26, 27).

4. *Sources of the Text.*

The text of the 'Herbarum Vivæ Eicones' has been considered by Ernst Meyer and others to be of little value, whereas E. L. Greene read into it various attempted improvements in classification and nomenclature (*vide infra*, p. 84). It consists, as Meyer says, largely of collected extracts from previous writers, among the early works frequently quoted being those of Dioscorides and Pliny, and the fifth century Latin compilation (**1, 21, 24**) circulated under the name of Lucius Apuleius Madaurensis (Apuleius Platonicus), a Platonic philosopher of the second century. There are numerous references to the opinions of the Arab physicians, such as Serapion, Mesue, Avicenna, and Rhazes, chiefly in regard to medicinal uses. Great indebtedness is also shown to the Italian botanists of the fifteenth and early sixteenth centuries—Hermolaus Barbarus, Nicolaus Leonicenus, Marcellus Virgilius, Pandulphus Collinutius, and Joannes Manardus, whose Latin translations of Dioscorides and commentaries on Dioscorides and Pliny seem to have formed the chief basis of Brunfels's work. Indeed, it seems probable that, but for the key to classical botany supplied by these Italian authors, the 'Herbarum Vivæ Eicones' would never have appeared. But the history of botany in the fifteenth century has yet to be written, and until then the precise debt of Brunfels to his Italian and other predecessors must remain a matter of conjecture.

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* The name is so spelt above the figure and in the index.

5. *The Draughtsmen of the 'Vivæ Eicones.'*

Ernst Meyer (30), Maiwald (28), and Arber (2, 3) considered that the figures were drawn as well as engraved by Johannes Weiditz (Hans Weyditz) of Strasburg, and Christ (12) has recently concluded that Weiditz was certainly the draughtsman, if not the engraver, but the hypothesis that Brunfels himself was the draughtsman was brought forward in 1919 by A. H. Church (13) in the following words: "From internal evidence it may be sufficiently assumed that Brunfels drew the figures himself, he had little money to pay for them being done, and in the absence of any claimant he should certainly be credited with them. No one but the man who had spent hours over them could have so insisted on the value and truth of his 'Vivæ Eicones.'" This does less than justice to the discernment and character of Brunfels. To one accustomed to the crude diagrammatic representations of plants in the 'Ortus Sanitatis' and Hieronymus von Braunschweig's 'Buoch von Distillierung' the figures of the 'Vivæ Eicones' must have come as a revelation of the possibilities of botanical illustration; and Brunfels, of all men, was most scrupulous to give credit where credit was due, as is evident from a close study of his herbal: "Singulis suum honorem dedimus, vel barbarissimis etiam" (ed. 1532, i, prefatory epistle to the Senate of Strasburg).

In reply to Church, Arber (3) cited the following passage from the Introduction to the 'Contrafayt Kreüterbuoch,' Cap. xxxii: "ist derhalb, an moeglichem fleiss nichts gespart worden, wie sich auch die formen disses buochs wol lasszen ansehen durch den hochberuempten meyster Hans Weyditz von Strassburg gerissen und contrafayt." This seems to indicate that Weyditz was responsible for the drawing as well as the engraving. The expression "gerissen und contrafayt" may, I think, be rendered "drawn and engraved" (pinxit et sculpsit), the word "contrafayt" apparently referring to the exact reproduction of the drawing on the wood block. In the introductory verses of the Latin edition Weyditz (Guidictius) is described as a "pictor" (designer). That Weyditz was not the only draughtsman and engraver, however, is evident from the fact that Brunfels refers in his book to the "pictores et sculptores" (i, 181) or "deliniatores et sculptores" (i, 217). On the latter page he explains that in order to keep the draughtsmen and engravers employed he was obliged to include certain herbs of which he knew nothing but the German names, though he had originally intended to include such plants in an appendix. Under "Weyssz Fleyschbluom" (ii, 59) he accepts the name given by the draughtsman when he drew it: "Huic flori nomen inditum a grapheo accepimus cum pingeret." In the prefatory paragraph of the Introduction to the 'Contrafayt Kreüterbuoch' Brunfels mentions that he has had to give way a good deal to the masters and journeymen-engravers (den Meistern und Contrafactyereren) as it was in their power to draw what they liked or were able to execute. In the thirty-second chapter of the same Introduction he explains that the absence of any definite arrangement in the book is due to his having had to take up each plant as the designer (Maler) finished it.

All these facts taken together lead to the conclusion that the figures were executed under the supervision of Weyditz by a staff of several draughtsmen and engravers, some of whom ranked in their craft-guild as masters and others as journeymen. The idea that Brunfels was responsible for any of the drawings may be dismissed.

6. *Nomenclature.*

The late E. L. Greene, in his scholarly and philosophical 'Landmarks of Botanical History' ascribed to Brunfels the credit of having quietly inaugurated the reform of the nomenclature of genera by the exclusion of certain generic names made up of two distinct words, but I have not succeeded in finding any definite evidence in support of this view. As recently pointed out by M. L. Green (**19**), "he seems to have thought one name as good as another, and to have used them more or less indifferently" with the obvious exception that a classical name had precedence over a vernacular one. He headed his chapter on Fumitory "*De Capno*," but used the name *Fumus terræ* above the figure; similarly, the chapter on the different kinds of Buttercup is entitled "*De Pede Corvino*," but in his own remarks ("Judicium nostrum") he adopted the name *Coronopus*, and the third figure bears the name *Crus Galli*; the wood Sanicle is indifferently styled *Sanicula* and *Diapensia*; and *Delphinium Consolida* is called *Consolida regalis* in one place (i, 84) and *Calcar equitis* in another (iii, 8).

7. *Taxonomy.*

Brunfels does not appear to have had any clear conceptions as to plant-classification; when he used the word "species" he did so in the general sense of "kind." One Brunfelsian "species" might differ very greatly or very slightly from another—thus his *Scrophularia maior*, *S. media*, and *S. minor* are now assigned to three different families, his *Cynoglossa vera* and *C. minor* to different genera, and his *Pentaphyllon maius* and *P. minus* to different species of the same genus. Others were mere forms of the same species. One of his species of *Perfoliata* is *Bupleurum rotundifolium* L. (*Umbelliferæ*), whereas the two others are respectively normal and abnormal states of *Listera ovata* R. Br. (*Orchidaceæ*).

Nine pages were devoted to the taxonomy of the 'Herbarum Vivæ Eicones' by E. L. Greene (20), who claimed that Brunfels introduced various improvements in classification—for example, in recognizing the genus *Ficaria* by adopting that name in place of *Scrophularia minor*. But in the text of the 'Vivæ Eicones' three species of *Scrophularia* are set out with their synonymy, and *Ficaria* is given as a synonym of *Scrophularia minor*. In order to support his contention, Greene here appears to assume that the name accompanying the *figure* was the one adopted by Brunfels. In the case of *Capnos* (vide supra, p. 84), however, where he is endeavouring to prove that Brunfels rejected certain binary generic names, he accepts the name used in the *text*, as representing the choice of Brunfels. As the text appears to have been prepared first, the latter view is the more probable, though, as suggested above, Brunfels seems to have regarded the choice of names almost as a matter of indifference.

Greene suggests that the caption "*De Galiopsi* simili Urticis herba, Dioscorides" indicates that Brunfels really regarded *Galiopsis* as generically distinct from *Urtica*, and translates it as follows:—"Concerning *Galiopsis* of Dioscorides, an herb resembling the nettles." The real meaning, however, seems to be "Dioscorides on *Galiopsis*, an herb resembling the nettles." It was Dioscorides who wrote that the whole plant of *Galiopsis* with its stem and leaves *resembled* a nettle. Brunfels actually followed Pliny and Hermolaus Barbarus in including it under the nettle genus, *Urtica*. The picture of sixteenth century botany given in Greene's 'Landmarks' appears to be wonderfully true in its general outlines, but he painted with a broad brush and the details do not always bear inspection.

The botanical classification of the early sixteenth century was sometimes based on obvious vegetative characters or general facies, sometimes on medicinal properties, and only seldom on the inflorescence or flowers. The genus *Plantago* comprised herbs with elliptic or lanceolate 7-nerved leaves, as is indicated by its synonym *Septinervia*: hence it naturally included the Water Plantain, *Alisma Plantago-aquatica* L., in addition to the true Plantains. Plants that in some way resembled a serpent were assigned to *Colubrina*, the twisted rhizome of *Polygonum Bistorta* L. and the snake-like markings on the stem of *Dracunculus vulgaris* Schott being sufficient warrant for their inclusion in the same genus. *Consolida*, with its variant *Solidago*, denoted herbs that promoted the healing of flesh and especially of wounds, and covered a wide assortment of unrelated genera. Orchids with two or more tubers were known as *Satyrion*, an example of phallic symbolism. The leaves of *Verbena* had been described by Dioscorides and Pliny as cut like those of an oak—that is, pinnatifid,—and this explains the association by Brunfels of *Verbena officinalis* L., *Senecio vulgaris* L., and *Sisymbrium officinale* L. under the same generic name. *Parthenium* comprised six species of *Compositæ-Anthemideæ*, belonging to the genera *Chrysanthemum*, *Tanacetum*, *Matricaria*, *Anthemis*, and *Artemisia*, four of them being highly aromatic. With them was associated the Marigold, *Calendula officinalis* L. (tribe *Calenduleæ*), also a strong-smelling plant and two species belonging to other families—namely, Dog's Mercury, *Mercurialis annua* L., and Pellitory, *Parietaria officinalis* L.

8. *Superstition and Fable.*

Traces of mediæval superstition are discernible in the volumes of Brunfels, who considered the blood-red blotch on the leaves of his *Pulicaria* (*Polygonum* spp.) the greatest miracle of plant-life :—"This herb is also of two kinds, large and small, but both have a peach-like leaf which is blotched in the middle, just as if a drop of blood had dripped on to it, a mighty and marvellous sign which astonishes me more than any other miracle of the herbs" ('Contrafayt Kreüterbuoch,' p. clxviii). The influence of the doctrine of signatures can be detected in such "genera" as *Colubrina*, *Satyrion*, and *Hepatica*. His account of *Narcissus* (*Hermodactylus*) is a mixture of fact and fable :—"There are, they say, two kinds of the flower, namely, male and female, purple, yellow and white ; also it flowers twice in the year, once in March and then in September ; it sheds its seeds at Whitsuntide, and in the beginning of the year forsooth it springs up with white and yellow flowers, and in the winter with purple ones. They say that they have caught it in a miracle of nature ; for if anyone tried to dig it up in March he could easily uproot it with a single finger, but from that time onwards it settles down daily deeper and deeper into the ground until September, when it can scarcely be dug up without a great deal of trouble. In the meantime, it lurks in the earth at the depth of one cubit, but in the winter it soon moves upwards again, so that it comes out even above the ground with its first bloom at the breath of spring. We also have found this, and have observed that the root is at first soft and bulbous and the leaves are like those of *Porrum* [Leek] and *Satyrion* [*Orchis* and *Ophrys*], but soon the root hardens, and the leaves become more fleshy, coming from the root without a stalk. From September onwards it is quite hard and very deeply buried, but with a rather delicate and lily-like flower, opening about a hand's-breadth above the ground, after the second mowing of the meadow" (i. 135).

The yellow and white spring-flowering kinds of "*Narcissus*" are the Daffodil (*Narcissus Pseudo-Narcissus* L.) and the Snowflake (*Leucojum* *vernum* L.) respectively, as is obvious from the figures. The purple autumn-flowering kind (known to the Arabs and Neotherici as *Hermodactylus*), with a liliaceous perianth and firm deeply-buried "root," is evidently the Autumn Crocus (*Colchicum autumnale* L.), with its deeply-seated corm. Later on Brunfels seems to have discovered that the purple-flowered kind was quite distinct from the yellow and white kinds (Contr. Kreüt. p. liii; iii. 10, 11, *Narcissus, Hermodactyli*); and it was figured under the names *Premulæ veris bulbus* and *Crocus* (Saffron) in the posthumous third volume of the Latin version and the second volume of the German one. In both volumes it was confused with the Saffron Crocus (*Crocus sativus* L.). The origin of the fable may have been this: that the same vernacular name, "Zeitloesslin," was given in Alsace to the Daffodil, the Snowflake, and the Autumn Crocus. But the fable evidently arose several centuries earlier, since Albertus Magnus (31) described *Hermodactilus* as having sometimes white and sometimes yellow flowers.

9. *The Terms "Male" and "Female."*

Brunfels's ideas of sex in plants were based on several considerations. His use of the terms "male" and "female" sometimes indicated differences in flower-colour between two plants which were otherwise more or less similar, the deeper colour in the following order—red, blue (purple, violet), yellow, white—being "male" and the paler colour "female." This is illustrated by the following examples:—Male, red; female, blue: *Anagallis arvensis* L., *A. fœmina* Mill., the allocation of the sexes being taken in this instance from Dioscorides.—Male, violet; female, yellow: *Verbena officinalis* L., *Senecio vulgaris* L., and *Sisymbrium officinale* L.—Male, purple; female, yellow or white: *Colchicum autumnale* L., *Narcissus Pseudo-Narcissus* L., and *Leucojum vernum* L.—Male, purple or pinkish; female, white: *Lamium maculatum* L., *L. album* L.; *Symphytum officinale* L. var. *purpureum* Pers., do. var. *ochroleucum* DC.; *Leonurus Cardiaca* L., *Marrubium vulgare* L.—Male, yellow; female, white: *Nuphar luteum* Sm., *Nymphæa alba* L.; *Sedum acre* L., *S. album* L.

In other cases the normal or more complete plant was considered as male, the abnormal or imperfect one as female, as in *Polygonum Bistorta* L., *Listera ovata* L., and *Ruscus Hypoglossum* L. Normal *Listera ovata* was originally styled *Perfoliata mascula*, but when it was discovered to be a spurious kind it was designated *Perfoliata fœmina* in contrast to the genuine kind, *Perfoliata vera* (*Bupleurum rotundifolium* L.).

It is interesting to note that in the sixteenth century the German word "braun" was applied to what botanists now call "purple" (purpureus). Thus the purple Comfrey, the purple Dead-nettle, and the purplish-pink *Melampyrum arvense* L. were all "braun" to Brunfels. Similarly, Fuchs ('Historia,' 893) gave "Brauner Fingerhut" as the German name of the Foxglove, and translated it into Latin as *Digitalis purpurea*.

10. *Garden Flowers.*

Brunfels mentions various plants as being grown in gardens for their decorative flowers or sweet scent. Yellow Bachelor's Buttons (*Ranunculus acris* L., flore pleno) was used for bridal wreaths:—"est domestica et hortulana, sativa, foliatis, luteis, et repletis floribus, qua ad coronas utuntur nymphæ." Monkshood, 'Isenhuetlin' (*Aconitum Napellus* L., sensu lato), which he regarded as another kind of Crowfoot (*Pes Corvi*), was a favourite flower of the German matrons. Wallflower (*Cheiranthus Cheiri* L.) was considered to be a yellow kind of "Violet" (Geel Violaten, Gelben Violaten). The Stock (*Matthiola incana* R. Br.) and the Pinks (*Dianthus* spp.) were associated on account of the clove-like fragrance of their flowers; some authors called them "Garyophyllus" (Clove), but Brunfels was inclined to refer them to "Cheiri" (*Cheiranthus*). The Sweet Violet (*Viola odorata* L.) was valued both for its perfume and colour, and the Wild Pansy (*Viola tricolor* L.) was grown for the sake of its flowers, which were regarded as symbolic of the Holy Trinity and were used for wreaths. Garlands were woven also from the Rose Campion (*Lychnis Coronaria* L.), two kinds of which were then in cultivation, one with white, the other with rose-purple flowers. Dittany (*Dictamnus albus* L.) was doubtless prized for its aroma as well as for its handsome inflorescence. Marigold (*Calendula officinalis* L.) was cultivated for its ornamental flowers, of which garlands were made. Rosemary (*Rosmarinus officinalis* L.) was also used by the garland-makers ("Rosmarinum, quo Coronarii utuntur"). Among bulbous plants were the Madonna Lily (*Lilium candidum* L.), Orange Lily (*L. croceum* Chaix), and Martagon Lily (*L. Martagon* L.). *Iris germanica* L. was grown as an ornamental plant as well as for the sake of its fragant rhizome, which is one of the sources of orris-root. Then, as now, it was common on old walls in Alsace. It is noteworthy that eight of the above-mentioned species were also coronary plants of ancient Greece or Rome.

11. *The Scientific Value of the Herbal.*

The herbal possesses a threefold importance: (1) it affords clues to the identity of many of the plants known in mediæval times; (2) it contains numerous previously unknown species; (3) it includes many figures which may be regarded as the historic types of Linnean species.

(1) As has been shown (p. 82), Brunfels in most cases accepted—or, at all events, cited—the traditional names used by the herbalists of his day, which appear to have been handed down for several centuries in some cases. For instance, the excellent description of *Borago* supplied by Albertus Magnus (circa 1250) in his 'De Vegetabilibus Libri VII' proves that it was identical with the species figured by Brunfels in 1530 under the same name, and now known as *Borago officinalis* L. Hence the names employed

by mediæval botanists may be associated, in the absence of evidence to the contrary, with the pictures in Brunfels's Herbal. A single case may be mentioned as an illustration. Albertus Magnus described *Verbena* in the following words:—"Verbena est herba parvis foliis, in siccis crescens, duris stipitibus et siccis. Et est duorum modorum: una enim habet florem parvulum croceum, et altera habet parvulum eiusdem figuræ azurinum." His two kinds of *Verbena* were identified by Meyer and Jessen (**31**, p. 579) with *Anagallis fœmina* Mill. ("*A. arvensis* Linn.") and *A. arvensis* L. ("*A. phœnicea* Lam.") respectively. But the stems of the Blue and Scarlet Pimpernel are not particularly hard, nor are their leaves small in proportion to the size of the plant; and it is difficult to believe that Albertus Magnus could have called the flower of the Blue Pimpernel "yellow" ("croceus"). Two of the three species figured by Brunfels as *Verbena* were *Verbena officinalis* L. and *Sisymbrium officinale* Scop., and these seem to fit the description given by Albertus Magnus. The latter described the flower of the Sweet Violet and that of Chicory as "azurinus," so that he evidently used this term in the sense of violet as well as for blue. And when it is remembered that *Verbena officinalis* was known in the 12th century as *Verbena* ('Apuleius Barbarus,' **21**, t. lxix) there need be no hesitation in accepting it as the "azure-flowered" kind of *Verbena* mentioned by Albertus Magnus. *Sisymbrium officinale* bears such a strong general resemblance to *Verbena officinalis* both in vegetative characters and in inflorescence that it may well be the yellow-flowered kind. Magnifying-glasses were then unknown, and, as seen by the naked eye, the flower of Vervain might be regarded as similar in shape to that of Hedge-Mustard.

(2) Among the species illustrated in Brunfels's Herbal there are forty-seven which appear to be "new." In the systematic conspectus (p. 113) these are distinguished by asterisks.

(3) Many of the species in Linné's 'Species Plantarum' were what are known as "book-species"—that is, they were based primarily (if not entirely) on descriptions and figures supplied by previous authors. For European plants the earliest work generally cited by Linné was Caspar Bauhin's 'Pinax' (1623); and the earliest work generally cited by C. Bauhin was Brunfels's Herbal. Hence a picture in the latter book frequently constitutes the primary historic basis of a Linnean species.

Linné included Brunfels among the "Auctores usitatiores" mentioned at the beginning of the 'Species Plantarum,' but only the first volume of the herbal was represented in his library, and there appears to be no evidence that he used the second and third volumes of the Latin version, or the 'Contrafayt Kreüterbuoch.' Hence it is only in the first volume that the figures can be regarded as typifying Linnean species. Deducting those figures not cited or erroneously cited by Bauhin, and others of which the identification might be disputed, there remain over sixty figures which have a *prima facie* claim to be regarded as the types of Linnean species. In the case of the figures of entirely new plants such as Kuchenschell (*Anemone Pulsatilla*) and Gauchbluom (*Cardamine pratensis*) this claim will perhaps not be disputed, and the same applies to those unknown before the mediæval period, such as *Capillus Veneris* Brunf. (*Asplenium Ruta-muraria*) and *Consolida regalis* Brunf. (*Delphinium Consolida*). Those known already in ancient Greece or Rome under their present generic names come in a slightly different category, as it might be argued that the classical description was the historic basis on which the modern name rested, and that they have been known continuously under the same name from classical times onwards. *Verbena mas* Brunf. (*Verbena officinalis*) is a case in point. According to Dyer (**17**, p. 83) "there is a continuous tradition from its ceremonial use in classical times to its superstitious employment amongst Teutonic races to-day." In order to establish the actual types of the Linnean species concerned, an independent investigation is required in each case. Where there is evidence that Linné's description of a species was based on the specimen in his Herbarium, that should, of course, be regarded as the type.

12. *Identifications of the Figures.*

Owing to the absence of original descriptions, the illustrations given in the herbal afford the only means of identifying with any degree of certainty the plants actually known to Brunfels. The botanical identity of some of the figures is so obvious that no confirmation is required, but in most cases the determinations have been made or checked by means of comparison with the illustrations in Reichenbach's 'Icones Floræ Germanicæ' and 'Plantæ Criticæ,' Sowerby's 'English Botany,' and other works, and the large collections of plant-drawings at the Kew Herbarium and the Natural History Museum. Comparison has also been made in certain cases with living material, when available, and with herbarium specimens. Useful clues to the identity of some of the species have been obtained from Pritzel and Jessen's dictionary of German plant-names, in which many of the names employed by Brunfels are cited.

Perhaps the most interesting new identification is that of the figure named "*Portulaca*," which is evidently *Isnardia palustris* L. (*Ludwigia palustris* Elliott). The earliest reference to this species previously noted seems to be in Morison's 'Præludia' (1669), as *Glaux major, palustris, flore herbaceo*, while the earliest record for Alsace given by Kirschleger (**25**) was from Lindern's 'Tournefortius Alsaticus' (1728). Brunfels's figure of *I. palustris* was published in 1536.

In the following enumeration a special running number has been assigned to each different figure. This is succeeded by the Latin and German names used by Brunfels, and references to the places of publication. Then follow the names used by Caspar Bauhin and Linné, the now accepted name being added where it is different from the Linnean. Notes regarding the identifications are appended where required. The following abbreviations have been adopted :—

C.B.P., Caspar Bauhin, Pinax ; C.K., Contrafayt Kreüterbuoch ; C.K. ii, Contrafayt Kreüterbuoch, Ander Teyl ; L. Sp., Linn. Sp. Pl. ed. 1 ; Latin names not actually occurring in Brunfels, but attributed to him by C. Bauhin, are followed by [C.B.P.]. Volume and page numbers without preceding letters indicate the Latin editions.

In order to facilitate consultation, the figures are arranged in the order in which they appeared in the Latin editions, and these are uniformly cited before the German edition ('Contrafayt Kreüterbuoch'), although in certain cases (*e.g.*, No 39) the figures in the latter were published first. The pages of vol. i (Latin ed.) are those of the editions of 1530 and 1532, unless otherwise stated: a reference to the 1539 edition is given where a figure occurs only in that edition, or on a different page. The pages of vol. ii (Latin ed.) are those of the edition of 1536 ; where those of the 1531 edition differ, they have been added in parentheses.

1. *Plantago maior*, Breyter Wegerich (Wegrich, Wegreich), i, 23 ; ed. 1539, 22 ; C.K. p. liv. *Plantago latifolia incana* C.B.P. 189. *Plantago media* L. Sp. 113.

2. *Plantago minor*, Spitzer Wegerich (Wegrich, Wegreich), i, 24 ; ed. 1539, 23 ; C.K. p. lv. *Plantago angustifolia major* C.B.P. 189. *Plantago lanceolata* L. Sp. 113.—Moretti determined the figure as *Plantago media* L., var.

3. *Plantago aquatica*, Froeschloeffelkraut, Wasszer Wegerich, ed. 1539, i, 24 ; C.K. p. lvi. *Plantago aquatica latifolia* C.B.P. 190. *Alisma Plantago-aquatica* L. Sp. 342.

4. *Plantago rubea*, Rot Wegerich (Wegrich, Wegreich), i, 25 ; C.K. p. lvii. *Plantago latifolia sinuata* C.B.P. 189. *Plantago major* L. Sp. 112.—Identified by Sprengel and Moretti with *Plantago crassa* Willd. (*P. crispa* Jacq.), which Decaisne (DC. Prodr. xiii, sect. 1, 695) regarded as probably an abnormal state of *P. major*.

5. *Helleborus niger*, Christwurtz, Nyeszwurtz, i, 30 ; iii, 3 (text) ; C.K. p. lxii. *Helleborus niger hortensis flore viridi* C.B.P. 185. *Helleborus viridis* L. Sp. 558.

6. *Nenufar mas*, Geel Seehbluom, i, 36 ; C.K. p. i. *Nymphæa lutea major* C.B.P. 193. *Nuphar luteum* (L. Sp. 510) Sm.

7. *Nenufar fœmina*, Weissz Seehbluom, i, 37 ; C.K. p. ii. *Nymphæa alba major* C.B.P. 193. *Nymphæa alba* L. Sp. 510.

8. *Ungula caballina*, Rosszhuob, Branntlattich, i, 41; iii. 7 (text); C.K. p. vi. *Tussilago vulgaris* C.B.P. 197. *Tussilago Farfara* L. Sp. 865.

9. *Aristolochia rotunda*, Ronde Holwurtz, Holwurtz das weiblin, i, 47 (in ed. 1539, "Holwurtz das maennlin"); C.K. p. cxlvii. *Fumaria bulbosa radice cava major* C.B.P. 143. *Fumaria bulbosa* var. *cava* L. Sp. 699. *Corydalis cava* (L.) Schweigger et Koerte.—Bubani (Fl. Pyren. iii, 272 : 1901), referred this figure of Brunfels doubtfully to *C. solida* Sw., but the larger size of the plant, the absence of cataphyllary leaves below the foliage-leaves, the undivided bracts, and the fact that the roots are scattered over the whole surface of the corm, instead of being confined to the base, seem to afford conclusive evidence against that identification and in favour of *C. cava*. As in other cases, two states of the same species were figured by Brunfels under different names. Bubani himself suggested that this might be the case: "Cum dubio retuli Brunfelsii figuram, nec me latet, novissime etiam, Moretti, cum altero ejusdem loco, p. 48, ambo ad *C. cavam* attulisse."

10. *Aristolochia longa* Lang Holwurtz, Holwurtz das maennlin, i, 48 (in ed. 1539 omissa); C.K. p. cxlvi. *Corydalis cava* (L.) Schweigger et Koerte.

11. *Aristolochia rotunda*, *Aristolochia vera*, Osterlucey, Holwurtz das weiblin, ed. 1539, i, 48; iii, 10, sub voce *Satyria* (text); C.K. ii, p. cxxiii. *Aristolochia Clematitis recta* C.B.P. 307. *Aristolochia Clematitis* L. Sp. 962.

12. *Arona*, Aron, Pfaffen pint, i, 56; iii, 3 (text); C.K. pp. lxvii, lxxiv. *Arum vulgare non maculatum* C.B.P. 195. *Arum maculatum* L. Sp. 966.

13. *Colubrina fœmina*, Naterwurtz weiblin, i, 61; C.K. p. lxxi. *Bistorta major radice minus intorta* C.B.P. 192. *Polygonum Bistorta* L. Sp. 360, abnormal condition with branched stem. A similar abnormality is recorded by Penzig, Teratologie, ed 2, iii, 180 (1922).—Moretti identified the figure as *Rumex aquaticus* L.

14. *Colubrina mas*, Naterwurtz (Noterwurtz, Notterwurtz) maennlin, i, 62; C.K. p. lxx. *Bistorta major radice magis intorta* C.B.P. 192. *Polygonum Bistorta* L. Sp. 360.

15. *Mercurialis altera*, Guot Heinrich (Heynrich), Schwerbel, i, 63, 260; C.K. p. lxxv. *Lapathum unctuosum* C.B.P. 115. *Chenopodium Bonus-Henricus* L. Sp. 218.

16. *Dracuntium* (*Dracontium*) *maius*, Schlangenkraut, ed. 1539, i, 63; iii, 4 (text); iii, 131; C.K. ii, p. cxxxiv. *Dracunculus polyphyllus* C.B.P. 195. *Arum Dracunculus* L. Sp. 964. *Dracunculus vulgaris* Schott.

17. *Asarum*, Haselwurtz, i, 71; iii, 4 (text); C.K. p. ix. *Asarum* C.B.P. 197. *Asarum europæum* L. Sp. 442.

18. *Consolida maior mas*, Walwurtz maennlin, i, 75 ; iii, 6 (text) ; C.K. p. xii. *Symphytum Consolida major* C.B.P. 259. *Symphytum officinale* L. Sp. 136, var. *purpureum* Pers. Syn. i. 161.

19. *Consolida maior fœmina*, Walwurtz weiblin, i, 76 ; iii, 6 (text) ; C.K. p. xiii. *Symphytum Consolida major* C.B.P. 259. *Symphytum officinale* L. Sp. 136, var. *ochroleucum* DC. Prodr. x, 37.—Brunfels (C K. p. xiv) mentions that there are two kinds of Grosz Walwurtz (*Consolida maior*), a "male" kind with brown (*i.e.*, purple) flowers, and a "female" with white flowers. C. Bauhin also remarks that the purple or purplish-blue flowered form was called the male kind, and the white or yellowish form the female kind.—Moretti identified Walwurtz weiblin with *Symphytum tuberosum* L.

20. *Sanicula Sanicula maior* (vide ii, 84). *Diapensia*, Sanickel, i, 80 ; iii, 8 (text) ; C.K. p. xvi. *Sanicula officinarum* C.B.P. 319. *Sanicula europæa* L. Sp. 235.

21. *Consolida regalis*, Calcar equitis, Rittersporen, i, 83 ; iii, 8 (text) ; C.K. p. xviii. *Consolida regalis arvensis* C.B.P. 142. *Delphinium Consolida* L. Sp. 530.

22. *Tormentilla*, Tormentill. i, 85 ; iii, 7 (text) ; C.K. p. xx. *Tormentilla Sylvestris* C.B.P. 326. *Potentilla erecta* (L. Sp. 500) Hampe.

23. *Betonica*, Betonien (Brun Betonien, Braun Betonien), i, 88; iii, 8 (text) ; C.K. p. xxiii. *Betonica purpurea* C.B.P. 235. *Stachys officinalis* (L. Sp. 573) Trevisan.

24. *Consolida media*, Gulden Guntzel, i, 95 ; C.K. p. cxc. *Ajuga genevensis* L., *teste* Kirschl. Fl. ii, p. xv.—Cited by Caspar Bauhin (Pinax, 260) under his *Consolida media pratensis cœrulea*, which is a synonym of *Ajuga reptans* L. Sp. 561. Kirschleger at first (Fl. i, 623) referred this figure to *A. reptans*, but later (Fl. ii, p. xv) identified it without hesitation as *A. genevensis*, doubtless on account of the absence of stolons, and the hairy stem and leaves.

25. *Herba paralysis*, *Flores clavium*, *Claris S. Petri*, Geel Himmelschlüsszel (Hymmelschlüsszel), Weissz Betonien, i, 96; iii, 8 (text); C.K. p. xxvii. *Verbasculum pratense odoratum* C.B.P. 241. *Primula veris* L. Sp. 142.

26. *Herba paralysis alba* [C.B.P.], Weissz Hymmelschlüssel, i, 97 ; C.K. p. xxviii. *Verbasculum pratense vel sylvaticum inodorum* C.B.P. 241. *Primula elatior* (L. Sp. 143) Schreb.

27. *Fumus terræ*, *Fumaria herba*, *Capnos*, *Capnitis*, Erdtrauch, Erdrouch, Daubenkropff, i, 99; iii, 9 (text); C.K. p. xxx. *Fumaria officinarum et Dioscoridis* C.B.P. 143. *Fumaria officinalis* L. Sp. 700.

28. *Satyrion primum* [C.B.P.], Stendelwurtz, i, 103. *Orchis purpurea* Huds. (*O. fusca* Jacq.) *teste* Kirschl. Fl. ii, p. xv.—Cited by C. Bauhin (Pinax, 80) under his *Cynosorchis latifolia hiante cucullo major*, which is one of the synonyms cited under *Orchis militaris* L. Sp. 941. The figure was identified as *O. militaris* by Sprengel and Moretti.

29. *Satyrion mas*, Knabenkraut (Knabenkraut maennlin), i, 104 ; C.K. p. xxxv. *Orchis militaris* L. (*O. cinerea* Schrank), *teste* Kirschl. Fl. ii, pp. xv, 128.—Identified as *Orchis simia* Lam. by Moretti. Sprengel listed it as *O. mascula* L., but the narrow lateral lobes of the labellum and the short spur are quite inconsistent with that species.

30. *Cynosorchis*, Ragwurtz, i, 104 ; C.K. p. xxxviii, fig. sinistra. *Orchis morio* L. Sp. 90, *teste* Kirschl. Fl. ii, p. xv, 130.—Cited by C. Bauhin (Pinax, 81) under his *Orchis morio mas foliis maculatis*, which is a synonym of *O. mascula* L.

31. *Satyrion quartum* [C.B.P.], Knabenkraut, i, 105 ; C.K. p. xxxvii. *Ophrys fuciflora* Reichb. (*O. Arachnites* Reichard).—Identified as *Ophrys myodes* Jacq. (*O. muscifera* Huds.) by Sprengel, as *O. apifera* Huds. by Moretti, and as *O. aranifera* Huds. by Kirschleger, Fl. ii, p. xv. I am indebted to Mr. V. S. Summerhayes for the following note : " Brunfels's drawing agrees with *Ophrys fuciflora* Reichb. (*O. Arachnites* Reichard) in the small petals, in the apparently forward projection of the appendage of the lip, and partly in the markings of the lip. It differs chiefly in the absence of any isolated spot on the lower part of the lip ; this spot is, however, not always present in *O. fuciflora*. *O. aranifera* Huds. has larger petals and no definite appendage to the lip."

32. *Satyrion odoriferum*, Wolschmackend Knabenkraut, i, 105 ; C.K. p. xxxviii, fig. dextra. *Triorchis alba odorata minor* C.B.P. 84. *Spiranthes spiralis* (L. Sp. 945) C. Koch.

33. *Satyrion fœmina*, Knabenkraut weiblin, i, 106 ; C.K. p. xxxvi. *Orchis palmata angustifolia minor* C.B.P. 85. *Gymnadenia conopsea* (L. Sp. 942) R. Br.

34. *Buglossa sylvestris*, Wild Ochszenzung, i, 111 ; C.K. p. xli. *Echium vulgare* L. Sp. 139.—C. Bauhin referred this figure erroneously to his *Buglossum sylvestre minus*, which is *Lycopsis arvensis* L.

35. *Buglossa*, Ochszenzung, i, 112 ; C.K. p. xl. *Buglossum Angustifolium majus* C.B.P. 256. *Anchusa officinalis* L. Sp. 133.

36. *Borago*, Burretsch, i, 113 ; C.K. p. xlii. *Buglossum latifolium, Borrago* C.B.P. 256. *Borago officinalis* L. Sp. 137.

37. *Verbena mascula*, Yszenkraut maennlin, i, 119 ; C.K. p. xlv. *Verbena communis cœruleo flore* C.B.P. 269. *Verbena officinalis* L. Sp. 20.

38. *Verbena fœmina*, Yszenkraut weiblin, Gryndtkraut, i, 120. *Senecio minor vulgaris* C.B.P. 131. *Senecio vulgaris* L. Sp. 867.

39. *Verbena fœmina*, Yszenkraut weiblin, ed. 1539, i, 120; C.K. p. xlvi. *Erysimum vulgare* C.B.P. 100. *Sisymbrium officinale* (L. Sp. 660) Scop.

40. *Chamædrys*, *Gamandræa*, Gamenderlin, i, 125; iii, 10 (text); C.K. p. xlix. *Chamædrys spuria minor rotundifolia* C.B.P. 249. *Veronica Chamædrys* L. Sp. 13.

41. *Narcissus luteus*, Geel Hornungsbluom, i, 129, fig. sinistra; iii, 10 (text); C.K. p. lii, fig. dextra. *Narcissus sylvestris pallidus calice luteo* C.B.P. 52. *Narcissus Pseudo-Narcissus* L. Sp. 289.

42. *Narcissus albus*, Weissz Hornungsbluom, i, 129, fig. dextra; C.K. p. lii, fig. sinistra. *Leucoium bulbosum vulgare* C.B.P. 55. *Leucojum vernum* L. Sp. 289.

43. *Leucoium*, Cheiri, Geel Violaten, i, 136; iii, 5 (text); C.K. p. xcvi. *Leucoium luteum vulgare* C.B.P. 202. *Cheiranthus Cheiri* L. Sp. 661.

44. *Viola sativa* [C.B.P.], Zamme Violaten, i, 137, fig. super.; C.K. p. xcv. *Viola Martia purpurea flore simplici odoro* C.B.P. 199. *Viola odorata* L. Sp. 934.

45. *Viola alba* [C.B.P.], Weissz Violaten, i, 137, fig. infer. sinistra; C.K. p. xciv, fig. sinistra. *Viola Martia alba* C.B.P. 199. *Viola odorata* var. β L. Sp. 934.—Identified as *Viola palustris* L. by Sprengel. Moretti identified this and the following species as *V. canina* L. and *V. flavicornis* Sm. respectively.

46. *Viola sylvestris* [C.B.P.], Wilde Violaten, i, 137, fig. infer. dextra; C.K. p. xciv, fig. dextra. *Viola hirta* L. Sp. 934, *fide* Linn. *ipso.*—Accepted as *V. hirta* by Kirschleger.

47. *Pes corvi primus*, Wasser Hanenfuessz, i, 143; C.K. p. cxxvi. *Ranunculus nemorosus* DC., *teste* Kirschl. Fl. ii, p. xv.

48. *Pes corvi flore pleno* [C.B.P.], Gefüilter Hanenfuesz, i. 144; C.K. p. cxxvii. *Ranunculus acris* L. Sp. 554, flore pleno.

49. *Crus galli*, Kleiner Hanfuosz (Hanenfuossz), i, 145; C.K. p. cxxviii, fig. infer. *Ranunculus pratensis radice verticilli modo rotunda* C.B.P. 179. *Ranunculus bulbosus* L. Sp. 554.

50. *Urtica major* [C.B.P.], Heyter Nesszeln (Nesszelen), i, 151; C.K. p. cxxii. *Urtica urens maxima* C.B.P. 232. *Urtica dioica* L. Sp. 984.

51. *Urtica labeo fœmina* [C.B.P.], Taub Nesszelen weissz, Daub Nesszel weiblin, i, 152; C.K. p. cxxi. *Lamium purpureum vel album non fœtens folio oblongo* C.B.P. 231. *Lamium album* L. Sp. 579.—Sprengel and Moretti

transposed the identifications of this and the following species, giving *Lamium lævigatum* L. as the equivalent of "*Urtica iners femina*," and *L. album* L. for "*Urtica iners mas*."

52. *Urtica labeo mas* [C.B.P.], Daub Nesszel maennlin, i, 153; C.K. p. cxx. *Lamium album* var. β L. Sp. 579. *Lamium maculatum* L. Sp. ed. 2, 809.—C. Bauhin cited *Urtica labeo mas* Brunf. under *Lamium purpureum fœtidum, folio subrotundo, sive Galeopsis Dioscoridis* (Pinax, 230), which is cited as a synonym under *Lamium purpureum* L. Sp. 579.

53. *Urtica minor* [C.B.P.], Brenn Nesszelen, i, 154; C.K. p. cxxiii. *Urtica urens minor* C.B.P. 232. *Urtica urens* L. Sp. 984.

54. *Marrubium mas* [C.B.P.], Andorn maennlin, i, 158; C.K. p. lxxxii. *Marrubium Cardiaca dictum* C.B.P. 230. *Leonurus Cardiaca* L. Sp. 584.

55. *Marrubium fœmina* [C.B.P.], Andorn weiblin, i, 159; iii, 12 (text); C.K. p. lxxxiii. *Marrubium album vulgare* C.B.P. 230. *Marrubium vulgare* L. Sp. 583.

56. *Hedera terrestris*, Gundelreb, i, 167; iii, 13 (text); C.K. p. lx. *Hedera terrestris vulgaris* C.B.P. 306. *Glechoma hederacea* L. Sp. 578.

57. *Eufragia*, Edler Augentrost, i, 169; iii, 13 (text); C.K. p. xxxiii. *Veronica pratensis serpillifolia* C.B.P. 247. *Veronica serpyllifolia* L. Sp. 12.

58. *Eufragia alba* [C.B.P.], Weisszer Augentrost, C.K. p. xxxiv. *Euphrasia officinarum* C.B.P. 233. *Euphrasia officinalis* L. Sp. 604.

59. *Linum*, Linsomen, Flachsz, i, 170; C.K. p. lxxx. *Linum sativum* C.B.P. 214. *Linum usitatissimum* var. β L. Sp. 277.

60. *Cynoglossa vera*, *Cynoglossa major* [C.B.P.], Grosse Hundtszung, i, 175; iii, 13 (text); C.K. p. clxix. *Cynoglossum majus vulgare* C.B.P. 257. *Cynoglossum officinale* L. Sp. 134.—Identified by Moretti with *Cynoglossum pictum* Ait., which does not occur in Alsace. Kirschleger considered it a good figure of *C. officinale*.

61. *Cynoglossa minor*, Klein Hundtszung, i, 176; iii, 13 (text); C.K. p. clxviii. *Echium Scorpioides palustre* C.B.P. 254. *Myosotis palustris* (L. Sp. 131) Lam.

62. *Vinca pervinca*, Yngryen (Yngruen), i, 178; iii, 13 (text); C.K. p. c. *Clematis daphnoides minor* C.B.P. 301. *Vinca minor* L. Sp. 209.

63. *Perfoliata mascula*, Durchwachsz maennlin, i, 182; ed. 1539, i, 183 (Durchwachsz weiblin); C.K. p. ccv (Wylder Durchwachsz maennlin). *Ophris bifolia* C.B.P. 87. *Listera ovata* (L. Sp. 946) R. Br.

64. *Perfoliata vera*, Durchwachsz, ed. 1539, i. 182; iii, 13 (text); C.K. p. cciv. *Perfoliata vulgatissima, sive arvensis* C.B.P. 277. *Bupleurum rotundifolium* L. Sp. 236.

65. *Perfoliata fœmina,* Durchwachsz weiblin, i, 183 ; C.K. p. ccvi (Wylder Durchwachsz Weiblin). *Ophris trifolia* C.B.P. 87. *Listera ovata* (L. Sp. 946) R. Br., an abnormal state with a third foliage-leaf (var. *trifoliata* Asch. et Graebn.).

66. *Narcissus martius,* Mertzenbluemlin, i, 184 ; C.K. p. ccxvii. *Hyacinthus stellaris bifolius Germanicus* C.B.P. 45. *Scilla bifolia* L. Sp. 309.

67. *Saxifragia,* Hoher Steynbrech, i, 185 ; C.K. p. ccxxxix. *Saxifraga rotundifolia alba* C.B.P. 309. *Saxifraga granulata* L. Sp. 403.

68. *Hepatica,* Edel Leberkraut, Hyrszklee (Hyrsszklee) i, 190 ; C.K. p. clxxix. *Trifolium hepaticum flore simplici* C.B.P. 330. *Anemone Hepatica* L. Sp. 538.

69. *Iecoraria,* Leberkraut, i, 191 ; C.K. p. clxxvii. *Lichen petrœus latifolius sive Hepatica fontana* C.B.P. 362. *Marchantia polymorpha* L. Sp. 1137. —Erroneously identified by Moretti as *Lichen pulmonarius* L. (*Lobaria pulmonaria* Hoffm).

70. *Coriandrum,* Coriander, i. 203 ; C.K. p. cxvii. *Coriandrum majus* C.B.P. 158. *Coriandrum sativum* L. Sp. 256.

71. *Basilicum,* Basilienkraut, i, 206 ; C.K. p. ccxlv. *Ocimum vulgatius* C.B.P. 226. *Ocimum Basilicum* L. Sp. 597, *teste* Sprengel, Gesch. Bot. i. 261.

72. *Lilium convallis, Lilium convallium, Lilium sylvestre,* Meyenbluemlin, i, 211 ; C.K. p. clxiv. *Lilium convallium album* C.B.P. 304. *Convallaria majalis* L. Sp. 314.

73. *Scrophularia maior,* Brunwurtz (Braunwurtz) i, 213 ; C.K. p. clxxiv. *Scrophularia nodosa fœtida* C.B.P. 235. *Scrophularia nodosa* L. Sp. 619.

74. *Scrophularia media,* Fotzwein, Fotzzwang, Wundtkraut, Knabenkraut, i, 214 ; C.K. p. clxxv. *Telephium vulgare* C.B.P. 287. *Sedum Telephium* L. Sp. 430.

75. *Scrophularia minor, Ficaria,* Fygwartzkraut, i, 215 ; C.K. p. clxxvi. *Chelidonia rotundifolia minor* C.B.P. 309. *Ranunculus Ficaria* L. Sp. 550.

76. Kuchenschell, Hacketkraut, i, 217 ; C.K. p. cxliii. *Pulsatillia folio crassiore et majore flore* C.B.P. 177. *Anemone Pulsatilla* L. Sp. 539.

77. *Flos cuculi* [C.B.P.], Gauchbluom, i, 218 ; C.K. p. cxxxi. *Nasturtium pratense magno flore* C.B.P. 104. *Cardamine pratensis* L. Sp. 656.

78. *Capillus Veneris,* Maurrut, Maurrauten, i, 219 ; iii, 14 (text) ; C.K. p. ccxlii. *Ruta muraria* C.B.P. 356. *Asplenium Ruta-muraria* L. Sp. 1081, forma *Brunfelsii* Heufer in Verh. Zool.-Bot. Ges. Wien, vi, 335 (1856).

79. *Hyoscyamus*, Bilsamkraut, Bylsamkraut, Sawbon, Iupitersbon, Schlaffkraut, i, 224; C.K. p. cxxxiv. *Hyoscyamus vulgaris vel niger* C.B.P. 169. *Hyoscyamus niger* L. Sp. 179.

80. *Pulegium*, Poley, i, 227; C.K. p. cxlvii. *Pulegium latifolium* C.B.P. 222. *Mentha Pulegium* L. Sp. 577.

81. *Pentaphyllon*, Fünffingerkraut, i, 233; iii, 6 (text). *Potentilla* sp.

82. *Chelidonia*, Schoelkraut, Schoelwurtz, i, 236; C.K. p. cxxxii. *Chelidonium majus vulgare* C.B.P. 144. *Chelidonium majus* L. Sp. 505.

83. *Anagallis mas*, Gauchheyl maennlin, i, 238; C.K. p. ccxii. *Anagallis phœniceo flore* C.B.P. 252. *Anagallis arvensis* L. Sp. 148.

84. *Anagallis fœmina*, Gauchheyl weiblin, i, 239. *Anagallis cœruleo flore* C.B.P. 252. *Anagallis fœmina* Mill. Gard. Dict. ed. 8, no. 2.

85. *Nigella*, Rattenbluomen, i, 241; iii, 16 (text); C.K. p. cclxiv. *Lychnis segetum major* C.B.P. 204. *Agrostemma Githago* L. Sp. 435.

86. *Matricaria*, Mettram, i, 245 (errore 249); iii, 63 (errore 62); C.K. p. cxli. *Matricaria vulgaris* C.B.P. 133. *Chrysanthemum Parthenium* (L. Sp. 890) Pers.

87. *Tanacetum*, Reynfarn, Reinfaren, i, 250; ii, 88 (ed. 1531, 87); C.K. p. cxcviii. *Tanacetum vulgare luteum* C.B.P. 132. *Tanacetum vulgare* L. Sp. 844.

88. *Cotula fœtida*, Hundtsbbluom, Krottendyll, i, 255; C.K. p. cxxxvii. *Chamæmelum fœtidum* C.B.P. 135. *Anthemis Cotula* L. Sp. 894.

89. *Calendula*, Ringelbluom, Ringelbluemlin, i, 257 (errore 253); iii, 77; C.K. p. ccx. *Caltha vulgaris* C.B.P. 275. *Calendula officinalis* L. Sp. 921.

90. *Oculus bovis*, *Buphthalmus*, Gaenszbluomen, Sanct Johanns Blum, i. 258 (errore 254); iii, 17 (text); C.K. p. cxliv. *Bellis sylvestris caule folioso major* C.B.P. 261. *Chrysanthemum Leucanthemum* L. Sp. 888.

91. *Parietaria*, S. Peterskraut, Tag und nacht, ed. 1539, i, 262; ii, 23 (ed. 1531, 19); iii, 72; C.K. p. clxii. *Parietaria officinarum et Dioscoridis* C.B.P. 121. *Parietaria officinalis* L. Sp. 1052.

92. *Hedera*, Maur Epphew (Ephew), ii, 6 (ed. 1531, 10); C.K. p. cl. *Hedera major sterilis* C.B.P. 305. *Hedera Helix* L. Sp. 202.

93. *Hedera*, Epphew, Baum Ephew, ii, 7 (ed. 1531, 11); C.K. p. cli. *Hedera arborea* C.B.P. 305. *Hedera Helix* L. Sp. 202.

94. *Matersylva*, *Caprifolium* (errore), Waltmeyster, Waldtmeister, ii, 15 (ed. 1531, 11 bis, 82); iii, 15 (text); C.K. p. clxxviii. *Asperula, sive Rubeola montana odorata* C.B.P. 334. *Asperula odorata* L. Sp. 103.

95. *Pulicaria mascula*, Flehkraut (Floehkraut) maennlin, ii, 18 (ed. 1531, 14); iii, 15 (text); C.K. p. clxvi. *Polygonum Persicaria* L., *teste* Kirschl. Fl. ii, p. xvi.—Cited by C. Bauhin (Pinax, 101) under *Persicaria urens seu Hydropiper*, which is a synonym of *Polygonum Hydropiper* L. Sp. 361.

96. *Pulicaria fœmina*, Flehkraut (Floehkraut) weiblin, ii, 19 (ed. 1531, 15); iii, 15 (text); C.K. p. clxvii. *Polygonum lapathifolium* L., *teste* Kirschl. Fl. ii, p. xvi.

97. *Fœniculum*, Fenchel, ii, 24 (ed. 1531, 20); C.K. p. ccii. *Fœniculum vulgare Germanicum* C.B.P. 147. *Anethum Fœniculum* L. Sp. 263. *Fœniculum vulgare* Mill.—Moretti erroneously identified the figure as Dill, *Anethum graveolens* L., failing to allow for the small scale of the drawing. The much-divided leaves, with their large and conspicuous vaginæ, are characteristic of Fennel. The figure was repeated under Dill, in vol. iii, p. 174—vide No. 207.

98. *Serpillum*, Quendel, Kyenlin, Huenerkoel, Huenerkoll, Wilde Boley, Unser frawen bettstro, Huenerserb, ii, 26 (ed. 1531, 22); C.K. p. clvi. *Serpyllum vulgare minus* C.B.P. 220. *Thymus Serpyllum* L. Sp. 590.

99. *Scabiosa*, Scabiosz, ii, 28 (ed. 1531, 24); C.K. p. xcii (*bis*). *Scabiosa major squammatis capitulis* C.B.P. 269. *Scabiosa columbaria* L. Sp. 99.—Linné does not cite the above synonym of Bauhin. This figure was erroneously identified by Moretti with *Scabiosa atropurpurea* L., which is not indigenous in Alsace, though now commonly cultivated there. It is an excellent picture of *S. columbaria*, and was cited by Kirschleger under that species as "*ic. optim.*"

100. *Solidago*, Masszlyeblin, Zeitloesslin, Klein Zeitloesslin oder Masszlieblin, ii, 29 (ed. 1531, 25); C.K. p. ccxcii. *Bellis sylvestris minor* C.B.P. 261. *Bellis perennis* L. Sp. 886.

101. *Eupatorium*, Wild Salbey, ii, 30 (ed. 1531, 26); C.K. p. lxxxviii. *Horminum pratense foliis serratis* C.B.P. 238. *Salvia pratensis* L. Sp. 25.—Identified by Sprengel as *Salvia Verbenaca* L.

102. *Solanum*, Nachtschatt, ii, 33 (ed. 1531, 29); C.K. p. cxciii. *Solanum officinarum* C.B.P. 166. *Solanum nigrum* L. Sp. 186.

103. *Pentaphyllum maius*, Gross Fünfffingerkraut, Fünfffingerkraut, ii, 37 (ed. 1531, 33); C.K. p. cliv. *Quinquefolium rectum luteum* C.B.P. 325. *Potentilla recta* L. Sp. 497, var. *obscura* Koch, Syn. 213 (1837).—Kirschleger identified the figure as *Potentilla argentea* L., to which I think it bears less resemblance, especially in the leaves.

104. *Pentaphyllon minus*, Klein Fünfffingerkraut, ii, 38 (ed. 1531, 34); C.K. p. cliii. *Quinquefolium majus repens* C.B.P. 325. *Potentilla reptans* L. Sp. 499.

105. Gensbluom, Genszbluom, ii, 38 (ed. 1531, 34); C.K. p. clviii. *Bursa pastoris minor loculo oblongo* C.B.P. 108. *Erophila verna* (L. Sp. 642) E. Mey. ex Garcke.

106. *Hyrundinaria*, Schwalbenwurtz, ii, 39 (ed. 1531, 36); C.K. p. clix. *Asclepias albo flore* C.B.P. 303. *Asclepias Vincetoxicum* L. Sp. 216. *Vincetoxicum officinale* Moench.

107. *Fragaria*, Erdtberkraut, Erdtboerkraut, ii, 40 (ed. 1531, 35); iii, 8 (text); C.K. p. cc. *Fragaria vulgaris* C.B.P. 326. *Fragaria vesca* L. Sp. 494.

108. *Herba Roperti*, Storckenschnabel, ii, 41 (ed. 1531, 37); C.K. p. cxcvi. *Geranium cicutæ folio minus et supinum* C.B.P. 319. *Erodium cicutarium* (L. Sp. 680) L'Hérit.—Erroneously identified with *Geranium Robertianum* L. by Sprengel, owing to the name *Herba Roperti* being used for it by Brunfels. Accepted by Church (**12**, p. 238) as "Herb Robert, from a dry situation."

109. Scheysszkraut, Lynkraut, ii, 43 (ed. 1531, 39); C.K. p. lxxviii. *Antirrhinum Linaria* L. Sp. 616. *Linaria vulgaris* Mill.—C. Bauhin (Pinax, 212) cited *Linaria* (and *Pseudolinum*) Brunf. under his *Linaria vulgaris lutea flore majore*, which is *Linaria vulgaris* Mill. But Brunfels himself had not connected Scheysszkraut with *Linaria* (i, 193; ii, 276, 304), as he stated that he knew only the German name of the plant.

110. *Scolopendrium*, *Scolopendrion*, *Lingua cervina*, Hirtzzung, ii, 44 (ed. 1531, 40); C.K. clxxi. *Lingua cervina officinarum* C.B.P. 353. *Phyllitis Scolopendrium* (L. Sp. 1079) Newman.

111. *Garyophyllata*, *Caryophyllata*, *Sanamunda*, *Herba Benedicta*, Benedictenwurtz, Benedictenwurtzel, ii, 46 (ed. 1531, 42); iii, 24; C.K. p. clx. *Caryophyllata vulgaris* C.B.P. 321. *Geum urbanum* L. Sp. 501.

112. *Cardo paris* (*panis*), Eberwurtz, ii, 47 (ed. 1531, 43); iii, 35; C.K. p. ccxviii. *Carlina acaulos magno flore* C.B.P. 380. *Cirsium acaule* (L. Sp. 1199) Weber ex Wiggers.—Cited by Sprengel as *Carlina acaulis* L.

113. *Acorus*, Geel wasser Gilgen, ii, 51 (ed. 1531, 47); C.K. p. cix. *Acorus adulterinus* C.B.P. 34. *Iris Pseudacorus* L. Sp. 38.

114. *Iacea nigra*, *Morsus Diaboli*, Abbissz, Teüffels Abbissz, ii, 54; C.K. pp. xc et xcii. *Succisa glabra* C.B.P. 269. *Scabiosa Succisa* L. Sp. 98. *Succisa pratensis* Moench.

115. *Herba fullonum*, Madelgeer, Magdelgeer, Kreützwurtz, ii, 56 (ed. 1531, 52); C.K. p. cxxxix. *Gentiana cruciata* C.B.P. 188. *Gentiana Cruciata* L. Sp. 231.

116. *Pes leonis*, *Leontopodion*, Synnaw, Unser Frawen Mantel, ii, 57 (ed. 1531, 53) ; iii, 79 ; C.K. p. clxxxi. *Alchemilla vulgaris* C.B.P. 319. *Alchemilla vulgaris* var. *β* L. Sp. 123.

117. *Trifolium maius*, Braun Fleyschbluom, ii, 58 (ed. 1531, 54) ; iii, 47 ; C.K. p. ccxix. *Melampyrum purpurascente coma* C.B.P. 234. *Melampyrum arvense* L. Sp. 605.

118. *Trifolium album*, Weissz Fleyschbluom, ii, 59 (ed. 1531, 55) ; iii, 48 ; C.K. p. ccxx. *Trifolium repens* L. Sp. 767, *fide* Erith, White Clover, 100 (1924).—Sprengel identified the figure as *T. hybridum* L.

119. *Flos S. Jacobi* [C.B.P.], Sanct Jacobs bluom, ii, 60 (ed. 1531, 56) ; C.K. p. cccxvii. *Jacobæa vulgaris laciniata* C.B.P. 131. *Senecio Jacobæa* L. Sp. 870.

120. Negelbluemlin, Negelkraut, ii, 61 (ed. 1531, 57) ; C.K. p. cxcii. *Matthiola incana* (L. Sp. 662) R. Br.—Bauhin does not cite this figure of Brunfels. Identified by Moretti as *M. annua* Sweet (*M. incana* var. *annua* Voss).

121. Dondernegelin, ii, 62 (ed. 1531, 58) ; C.K. p. xcvii. *Caryophyllus sylvestris vulgaris latifolius* C.B.P. 209. *Dianthus carthusianorum* L. Sp. 409.

122. *Rosmarinus*, Rosmarin, ii, 63. *Rosmarinus hortensis angustiore folio* C.B.P. 217. *Rosmarinus officinalis* L. Sp. 23.

123. *Lappa*, *Lappa maior*, Kletten, Grossz Kletten, ii, 65 (ed. 1531, 61) ; iii, 54 ; C.K. p. ccxciii. *Arctium minus*, Bernh., *teste* Kirschl. Fl. ii, p. xvi. —Cited by C. Bauhin (Pinax, 198) under his *Lappa major*, *Arcium Diosc.*, which is one of the synonyms cited under *Arctium Lappa* L. Sp. 816.

124. *Melilotum*, *Melilotum minus*, Steinklee, Kleiner Steinklee, ii, 68 (ed. 1531, 164) ; iii, 48 ; C.K. p. ccxx. *Trifolium pratense luteum capitulo breviore* C.B.P. 328. *Medicago lupulina* L. Sp. 779.

125. *Carduus*, *Dipsacus minor*, Saewdistel, Sew Distelen, ii, 69 (ed. 1531, 65) ; iii, 33 ; C.K. p. cclxxv. *Carlina vulgaris* L. Sp. 828.—Apparently not cited by C. Bauhin. Not a good figure, but the involucral bracts clearly indicate *Carlina vulgaris*. Moretti suggested that it might be *Carduus nutans* L., to which it bears no particular resemblance.

126. *Carduus fullonum*, Kartendystel, Karten distelen, ii, 70 (ed. 1531, 66) ; iii, 32 ; C.K. p. cclxxiv. *Dipsacus sylvestris aut Virga pastoris major* C.B.P. 385. *Dipsacus fullonum* var. *α* L. Sp. 97. *Dipsacus sylvestris* Mill. Gard. Dict. ed. 8, no. 1.

127. *Carduus albus*, Fechdystel, Fehdystel, ii, 71 (ed. 1531, 67) ; iii, 41; C.K. p. cclxxviii. *Carduus albis maculis notatus vulgaris* C.B.P. 381.

Silybum Marianum (L. Sp. 823) Gaertn.—Identified by Sprengel as *Cnicus oleraceus* L., which has very different phyllaries.

128. *Acetosa*, *Laputhum* (*Lappatum*) *acetosum*, Saurampffer, ii, 72 (ed. 1531, 68); iii, 83; C.K. p. cclxix. *Acetosa pratensis* C.B.P. 114. *Rumex Acetosa* L. Sp. 337.—Moretti identified it as *Rumex Pseudo-Acetosa* Bert., which is the typical wild form of *R. Acetosa* L.

129. *Unifolium*, Einblatt, ii, 72, fig. dextra (ed. 1531, 68); C.K. p. ccxxxv. *Lilium convallium minus* C.B.P. 304. *Maianthemum bifolium* (L. Sp. 316) F. W. Schmidt.

130. *Herba Trinitatis*, *Herba Sanctæ Trinitatis*, Dreyfaltigkeytbluemlin Dreyfaltigkeytbluom, ii, 73 (ed. 1531, 69); iii, 29; C.K. p. cxxx. *Viola tricolor hortensis repens* C.B.P. *Viola tricolor* var. *β* L. Sp. 935.

131. *Malva*, Gensbappel, Gaenszbappelen, i, 197 (text); ii, 74 (ed. 1531, 70); C.K. p. ccxxviii. *Malva sylvestris folio rotundo* C.B.P. 314. *Malva rotundifolia* L. Sp. 688.

132. *Malva equina*, Rosszbappelen, i, 197 (text); ii, 75 (ed. 1531, 71); C.K. p. ccxxvii. *Malva sylvestris folio sinuato* C.B.P. 314. *Malva sylvestris* L. Sp. 689.

133. *Herba Simeonis*, *Alcea*, Sigmarswurtz, i, 197 (text); ii, 76 (ed. 1531, 72); C.K. p. ccxxxii. *Alcea vulgaris major* C.B.P. 316. *Malva Alcea* L. Sp. 689.

134. *Nasturtium*, Kressen, Kresszen, ii, 77 (ed. 1531, 73); C.K. p. cclix. *Nasturtium hortense vulgatum* C.B.P. 103. *Lepidium sativum* L. Sp. 644.

135. *Menta*, *Mentha rubea*, *Mentha aquatica*, Fischmüntz, ii, 80 (ed. 1531, 76); C.K. p. ccliii. *Mentha* sp.—cited by C. Bauhin (Pinax, 227) under his *Mentha rotundifolia palustris, seu aquatica major*, which is one of the synonyms of *Mentha aquatica* L. Sprengel and Moretti identified the figure as *Mentha rubra* Sm. Kirschleger considered it to be *M. verticillata* Riv. (*M. gentilis* et *sativa* L.).

136. *Sanicula minor*, Kleiner oder Wylder Sanickel, Regenwürmlin (the root), ii, 84 (ed. 1531, 80); C.K. pp. xvii (text only), cxi. *Anemone nemorosa flore majore* C.B.P. 176. *Anemone nemorosa* L. Sp. 541.

137. *Sanguinaria*, Bluotkraut, ii, 85 (ed. 1531, 81); C.K. p. ccxxiii. *Atriplex* sp.—This figure is apparently not cited by C. Bauhin. The specimen was apparently diseased, with curled-up leaves, and the figure is very poor.

138. *Raponeoli*, Rapüntzlin, Rapüntzelin, ii, 86 (errore 84) (ed. 1531, 84); C.K. p. clxxiii. *Rapunculus esculentus* C.B.P. 92. *Campanula Rapunculus* L. Sp. 164.

139. *Artemisia*, Buck. Rote Buck, Beyfuossz, i, 265 (text); ii, 87 (ed. 1531, 83, errore "41"); C.K. p. ccxxxvi. *Artemisia vulgaris major* C.B.P. 137. *Artemisia vulgaris* L. Sp. 848.

140. *Salvia*, Salbey, ii, 92. *Salvia major* C.B.P. 237. *Salvia officinalis* L Sp. 23.

141. *Valeriana*, Baldrian, ii, 95 ; C.K. p. cxv. *Valeriana sylvestris major* C.B.P. 164. *Valeriana officinalis* L. Sp. 31.

142. *Ebulus*, Attich, iii, 22 ; C.K. ii, p. iv. *Sambucus humilis sive Ebulus* C.B.P. 456. *Sambucus Ebulus* L. Sp. 269.

143. *Brunella*, Braunellen, Brunellen, iii, 9 (text) ; iii, 26 ; C.K. p. cxc. *Trifolium pratense* L. Sp. 768.—Not identified by Sprengel or Moretti.

144. *Pimpinella*, Bibenell, iii, 28 ; C.K. p. ccxliv. *Pimpinella saxifraga major umbella candida* C.B.P. 159. *Pimpinella saxifraga* var. γ L. Sp. 263.

145. *Bursa pastoris maior*, Grossz Deschelkraut, iii, 30, fig. sinistra ; C.K. p. clxxxvi, fig. sinistra. *Bursa pastoris major folio sinuato* C.B.P. 108. *Capsella Bursa-pastoris* (L. Sp. 647) Medic.

146. *Bursa pastoris minor*, Kleyn Deschelkraut, iii, 30, fig. dextra ; C.K. p. clxxxvi, fig. dextra. *Nasturtium sylvestre Osyridis folio* C.B.P. 105. *Lepidium ruderale* L. Sp. 645.

147. *Chamæpitys*, Erd Weyrauch, Erdtweyrauch, iii, 36 ; C.K. p. ccxlix. *Veronica Teucrium* L. (Sp. ed. 2, 16) ; Reichb. Ic. Fl. Germ. xx. t. 1709.—Erroneously included by C. Bauhin (Pinax, 248) in his *Chamædrys minor repens*, which is a synonym of *Teucrium Chamædrys* var. β L. Sp. 565. Identified by Sprengel and Moretti as *Veronica prostrata* L.

148. *Endivia*, Andisten, Antiffien, iii, 38 ; C.K. p. cclxxxiv. *Lactuca sylvestris costa spinosa* C.B.P. 123. *Lactuca virosa* var. δ L. Sp. 795.—The figure purports to represent Endive, *Cichorium Endivia* L., but is apparently *Lactuca virosa*. Moretti identified it as *Sonchus ciliatus* Lam. (*S. oleraceus* L.), but the inflorescence and capitula suggest rather *Lactuca*.

149. *Affodillus*, Goldtwurtz, Goldwurtz, Gold Gilgen, iii, 43, fig. sinistra ; C.K. p. xvi. *Lilium floribus reflexis montanum* C.B.P. 77. *Lilium Martagon* L. Sp. 303.

150. *Lilium rubrum* [C.B.P.], Rote Gilgen, iii, 43, fig. dextra ; C.K. p. cviii. *Lilium croceum* Chaix.—Cited by C. Bauhin (Pinax, 76) under his *Lilium purpurocroceum majus*, which is one of the synonyms cited under *Lilium bulbiferum* L. Sp. 302. Moretti identified it as *L. bulbiferum*.

151. *Potentilla*, Genszerich, iii, 45 ; C.K. p. ccxxxiii. *Potentilla* C.B.P. 321. *Potentilla Anserina* L. Sp. 495.

152. *Melilotum majus* [C.B.P.], *Fragaria*, Guldener Klee, Hoher Steynbrech, iii, 49. *Melilotus officinarum Germaniæ* C.B.P. 331. *Trifolium Melilotus officinalis* L. Sp. 765. *Melilotus officinalis* (L.) Lam.—Moretti cited it under the synonym *M. arvensis* Wallr.

153. *Trifolium acetosum*, Gauch ampffer, Gauchklee, iii, 50; ed. 1540, iii, 50 (reduced and reversed); C.K. p. ccxxi. *Trifolium acetosum vulgare* C.B.P. 330. *Oxalis Acetosella* L. Sp. 433.

154. *Papaver rubrum* (*rubeum*), Klapper Roszen, iii, 52; C.K. p. ccxxiv. *Papaver erraticum majus* C.B.P. 171. *Papaver Rhœas* L. Sp. 507.

155. *Lappa minor*, Klein Kletten, iii, 55; C.K. p. ccxciv. *Lappa minor, Xanthium Diosc.* C.B.P. 198. *Xanthium strumarium* L. Sp. 987.

156. *Verbascum*, Wullkraut, iii, 57; C.K. ii, p. cxxxi. *Verbascum Thapsus* L. Sp. 177, *teste* Sprengel, Gesch. Bot. i, 260, et Kirschleger, Fl. i, 540.—Moretti referred it to *V. phlomoides* L.

157. *Eryngium*, Mannstrew, iii, 59; C.K. p. cclxxxi. *Carduus stellatus foliis papaveris erratici* C.B.P. 387. *Centaurea Calcitrapa* L. Sp. 917.

158. *Melissa*, Muotterkraut, iii, 61; C.K. p. ccci; C.K. ii, p. cxxxiii. *Melissa hortensis* C.B.P. 229. *Melissa officinalis* L. Sp. 592.

159. *Astrantia*, Meisterwurtz, iii, 65; C.K. ii, p. cxxi. *Imperatoria major* C.B.P. 156. *Peucedanum Ostruthium* (L. Sp. 259) Koch.—The Latin and German names *Angelica* also accompanying the figure relate not to this species but to *Archangelica officinalis*, no. 272.

160. *Agrimonia*, Odermeng, Odermenig, iii, 68; C.K. p. lxxxvi. *Eupatorium veterum sive Agrimonia* C.B.P. 321. *Agrimonia Eupatoria* L. Sp. 448.

161. *Dens leonis*, Sonnenwürbel, iii, 70; C.K. p. cclxxxix. *Dens Leonis latiore folio* C.B.P. 126. *Leontodon Taraxacum* L. Sp. 798. *Taraxacum officinale* Weber.

162. *Ruta*, Rautten, Raut, iii, 74 (errore 75); C.K. p. ccvii. *Ruta hortensis latifolia* C.B.P. 336. *Ruta graveolens* var. *β* L. Sp. 383.

163. *Hypericum*, S. Johanns Kraut, iii, 81; C.K. ii, p. cxli. *Hypericum vulgare* C.B.P. 279. *Hypericum perforatum* L. Sp. 785.

164. *Lappatum acutum*, Mengelwurt, iii, 84; C.K. cclxx. *Rumex obtusifolius*, L. Sp. 335.—Sprengel identified the figure as *R. acutus* L. Moretti referred it to *R. conglomeratus* Murr.

165. *Pyrola*, Wintergruen, Wintergryen, iii, 88; C.K. p. clxxxviii. *Pyrola rotundifolia major* C.B.P. 191. *Pyrola rotundifolia* L. Sp. 397.

166. *Volubilis*, Wynd, iii, 90 ; C.K. ii, p. vi. *Convolvulus major albus* C.B.P. 294. *Calystegia sepium* (L. Sp. 153) R. Br.

167. *Sigillum Salomonis*, Weisszwurtz, iii, 92 ; C.K. p. ccxvi. *Polygonatum multiflorum* (L. Sp. 315) All.—Cited by C. Bauhin (Pinax, 303) under his *Polygonatum latifolium vulgare*, which is one of the synonyms of *Convallaria Polygonatum* L. Sp. 315 (*Polygonatum officinale* All.). Both Kirschleger and Moretti identified the figure as *P. multiflorum*.

168. *Solsequium*, Wegwart, iii, 94 ; C.K. p. cclxxxvii. *Cichorium sylvestre sive Officinarum* C.B.P. 125. *Cichorium Intybus* L. Sp. 813.

169. *Uvularia*, Zapflin kraut maennlin, iii, 96, C.K. ii, p. cxxvi; and *Uvularia*, Zapflin kraut weiblin, iii, 97, C.K. ii, p. cxxvii. *Laurus Alexandrina fructu pediculo insidente* C.B.P. 304. *Ruscus Hypoglossum* L. Sp. 1041.—Referred to *Uvularia amplexifolia* L. (*Streptopus amplexifolius* Lam. et DC.) by Sprengel, who unaccountably overlooked the large foliaceous bract on the middle of the cladode. Moretti, who also overlooked the bract, referred the first figure (maennlin) to *Streptopus amplexifolius*, and the second (weiblin) to *Convallaria latifolia* Jacq. (*Polygonatum latifolium* Desf.).

170. *Anisum*, Enis (errore), *Enula Campana*, Alant, Alantwurtz, iii, 99 ; C.K. ii, p. cxxii. *Helenium vulgare* C.B.P. 276. *Inula Helenium* L. Sp. 881.—The leaves are erroneously represented as opposite in the figure. The identification as *Inula Helenium* was rejected by Moretti because the ray-florets were coloured blue in the copy which he had seen. Apart from the fact that the work was issued uncoloured, it may be noted that Brunfels himself described the flower as yellow : "cui superne luteus flos imminet."

171. *Portulaca*, Burtzelkraut, iii, 102 ; C.K. ii, p. cxxxvi. *Alsine palustris rotundifolia repens, foliis portulacæ pinguibus binis ex adverso nascentibus, flosculis virescentibus rosaceis* Lindern, Tournef. Alsat. 114, t. 2, lit. *b*. *Isnardia palustris* L. Sp. 120.—The figure purports to represent Purslane, *Portulaca oleracea* L., but cannot be that plant. It is evidently *Isnardia palustris* L., which, according to Lindern (1728), was known in Alsace under the vernacular name "Wasser Burtzel." Both Moretti and Bubani (Fl. Pyren. iii, 2) accepted it as *Portulaca oleracea*, but Bubani added "fig. mala."

172. *Carduus*, Unser frawen dystel, iii, 104. *Onopordon Acanthium* L. Sp. 827.

173. *Anisum*, Enisz, iii, 105. *Pimpinella Anisum* L. Sp. 264.

174. *Apium*, Epffich, Epffig, iii, 107 ; C.K. ii, p. cxxix. *Apium palustre et Apium officinarum* C.B.P. 154. *Apium graveolens* L. Sp. 264.

175. *Polypodium*, Engelfuossz, iii, 110. *Polypodium vulgare* C.B.P. 359. *Polypodium vulgare* L. Sp. 1085.—Figure afterwards repeated under another name (no. 184).

176. *Premulæ veris bulbus*, Zeitloesslin bluom (und wurtzel), iii, 115. *Colchicum commune* C.B.P. 67. *Colchicum autumnale* L. Sp. 341.

177. *Levisticus*, Liebstoeckel, Lyebstoeckel, iii, 116; C.K. ii, p. cxxv. *Ligusticum vulgare* C.B.P. 157. *Ligusticum Levisticum* L. Sp. 250. ***Levisticum officinale*** Koch.

178. *Lenticula aquæ*, Moerlynssen, iii, 118; C.K. ii, pp. viii (errore xiii), cxxxv, fig. super. *Lenticula palustris vulgaris* C.B.P. 362. *Lemna* sp.

179. *Auricula muris*, Meüszoerlin, iii, 119. *Pilosella major repens hirsuta* C.B.P. 262. *Hieracium Pilosella* L. Sp. 800.

180. *Piperitis*, Pfefferkraut, iii, 120; C.K. ii, p. cxxiv. *Lepidium latifolium* C.B.P. 97. *Lepidium latifolium* L. Sp. 644.

181. *Petroselinum*, Peterlin, iii, 121; C.K. ii, p. cxxviii. *Apium hortense, seu Petroselinum vulgo* C.B.P. 153. *Apium Petroselinum* L. Sp. 264.

182. *Liquiricia*, Suesszholtz, iii, 123; C.K. ii, p. cxxx. *Glycyrrhiza siliquosa vel Germanica* C.B.P. 352. *Glycyrrhiza glabra* L. Sp. 742.

183. *Centaurea*, Tausent guldin Kraut, iii, 125; C.K. ii, p. cxxxv, fig. infer. *Centaurium minus* C.B.P. 278. *Erythræa Centaurium* (L. Sp. 229) Pers. *Centaurium umbellatum* Gilib.

184. *Filix*, Waldtfar, Waldtfaren, iii, 127; C.K. p. cccv. *Polypodium vulgare* L. Sp. 1085.—Figure repeated from iii, 110 (no. 175).

185. *Smilax*, Welsch Bonen, Wyld Bonen, iii, 129; *Lupinus*, Feigbonen, C.K. ii, p. lxxii. *Lychnis sylvestris quæ Been album vulgo* C.B.P. 205. *Cucubalus Behen* L. Sp. 414. *Silene vulgaris* (Moench) Garcke.

186. *Althæa*, Ybisch, Ibisch, iii, 132; C.K. ii. p. cxliii. *Althæa Dioscoridis et Plinii* C.B.P. 315. *Althæa officinalis* L. Sp. 686.

187. *Allium*, Knoblauch, Moerzybel, iii, 135; C.K. ii, p. xxxviii. *Allium Scorodoprasum* L. Sp. 297.

188. *Porrum*, Wylder Lauch, iii, 136; C.K. ii, p. xxxv. *Porrum commune capitatum* C.B.P. 72. *Allium Porrum* L. Sp. 295.

189. *Allium sylvestre*, Wylder Knoblauch, iii, 137; C.K. ii, p. xxxiv. *Allium sylvestre latifolium* C.B.P. 74. *Allium ursinum* L. Sp. 300.

190. *Cuminum*, Küwich, iii, 138. *Umbelliferæ*.—The figure purports to represent Cumin, *Cuminum Cyminum* L. Sp. 254, but is obviously not that species.

191. *Rapistrum*, Hederich, iii, 139 (errore 159); C.K. ii, p. xliii. *Rapistrum flore luteo* C.B.P. 95. *Sinapis arvensis* L. Sp. 668.—Identified as *Raphanus Raphanistrum* L. by Sprengel.

192. *Cherefolium*, Koerbelkraut, iii, 141.—The text refers to *Chærophyllum sativum* C.B.P. 152, *Anthriscus Cerefolium* (L. Sp. 257) Hoffm., but the figure is unrecognizable.

193. *Absynthium*, Wermuot, iii, 142 ; C.K. ii. p. ix. *Absynthium Ponticum, seu Romanum officinarum, seu Dioscoridis* C.B.P. 138. *Artemisia Absinthium* L. Sp. 848.

194. *Cauda equina, Equisetum*, Schafftenhaw, Schaffthaew, iii, 144 ; C.K. ii, p. xi. *Equisetum limosum* L. Sp. 1062, *teste* Sprengel, Gesch. Bot. i, 262

195. *Crocus*, Saffron, Zammer Saffron, iii, 150 ; C.K. ii, p. cxi. *Colchicum autumnale* L. Sp. 341.—The figure purports to represent the Saffron Crocus, *Crocus sativus* C.B.P. 65, *Crocus sativus* var. *officinalis* L. Sp. 36, but as pointed out by Moretti it is *Colchicum autumnale*. It appears to have been redrawn from the figure on p. 115—vide Nos. 176, 243.

196. *Cartamus*, Wylder Saffron, iii, 152 ; C.K. ii, p. xvi. *Cnicus sativus, sive Carthamum officinarum* C.B.P. 378. *Carthamus tinctorius* L. Sp. 830.

197. *Genista*, Pfrymmen, iii, 154 ; C.K. ii, p. xii. *Genista angulosa et scoparia* C.B.P. 395. *Cytisus scoparius* (L. Sp. 709) Link.

198. *Rhabarbarum*, Rheubarbarum, Rheubarb, iii, 156 ; C.K. ii, p. civ *Hippolapathum latifolium* C.B.P. 115. *Rumex Patientia* L. Sp. 333.

199. *Origanum*, Wolgemuot, iii, 159 ; C.K. ii, p. c *Origanum sylvestre Cunila bubula Plinii* C.B.P. 223. *Origanum vulgare* L. Sp. 590.

200. *Pycnocomos*, Geysszbart, iii. 165 ; C.K. ii, p. cvi. *Angelica sylvestris minor sive erratica* C.B.P. 155. *Ægopodium Podagraria* L. Sp. 265.

201. *Lychnis agria, Lychnis agrestis*, Kornbluomen, iii, 167 ; C.K. ii, p. xviii. *Cyanus segetum* C.B.P. 273. *Centaurea Cyanus* L. Sp. 911.

202. *Sion*, Bachbung, Bachbunn, iii, 169 ; C.K. ii, p. cxvi. *Anagallis aquatica minor folio subrotundo* C.B.P. 252. *Veronica Beccabunga* L. Sp. 12. —Moretti identified the figure as *V. Beccabunga* var. *minor*.

203. *Millefolium in semine*, Garb im somen, Garb, iii, 170 ; C.K. ii, p. xx. *Sisymbrium Sophia* L. Sp. 659.

204. *Millifolium album*, Weisse Garb, iii, 171, fig. super. ; C.K. ii, p. xxi. *Millefolium vulgare album* C.B.P. 141. *Achillea Millefolium* L. Sp. 899.

205. *Millefolium parvum*, Kleyne Garb, iii, 171, fig. infer. ; C.K. ii, p. xxi, fig. infer. *Achillea Millefolium* L.

206. *Pastinaca*, Bestenau, iii, 172 ; C.K. ii, p. xxii. *Sphondylium vulgare hirsutum* C.B.P. 157. *Heracleum Sphondylium* L. Sp. 249.—The figure is supposed to represent the Parsnip, *Pastinaca sativa* L., but really belongs to *Branca ursina*, Baerenklaw, iii, 149, and may have been intended by Brunfels to accompany the text of that species.

207. *Anethum*, Dyll, iii, 174; C.K. ii, p. xxvi.—The figure purports to represent Dill (*Anethum graveolens* L.), but is actually a reproduction of the figure of Fennel (*Fœniculum vulgare* Mill.) given in vol. ii, p. 24—vide No. 97.

208. *Asparagus*, Spargen, iii, 176; C.K. ii, p. xxiv. *Asparagus sativa* C.B.P. 489. *Asparagus officinalis* var. *altilis* L. Sp. 313.

209. *Canabis*, Hanff, Harff, iii, 178; C.K. ii, p. xxviii. *Cannabis sativa* C.B.P. 320. *Cannabis sativa* L. Sp. 1027.

210. *Betonica alba*, Weissz Betonien, iii, 180. *Betonica alba* C.B.P. 235. *Betonica officinalis* var. *alba* L. Sp. 573. *Stachys officinalis* (L.) Trevisan, flore albo.—Brunfels states that he received *Betonica alba* from Tragus. The latter (Stirp. Comment. i, 197) called it *Betonica candida*, and mentioned that it differed from *Betonica purpurea* only in the colour of the flower. The figure was identified by Moretti as *Stachys recta* L.—erroneously, in my opinion.

211. *Cucurbita*, Kürbsz, iii, 188; C.K. ii. p. lxxviii. *Cucurbita lagenaria flore albo, folio molli* C.B.P. 313. *Cucurbita lagenaria* L. Sp. 1010. *Lagenaria vulgaris* Ser.

212. *Napi*, Nopen, iii, 193. *Năpus sativa* C.B.P. 195. *Brassica Napus* var. *β* L. Sp. 666.

213. *Rapa*, Ruob, iii, 194; C.K. ii, p. xlvi. *Rapa sativa rotunda* C.B.P. 89. *Brassica Rapa* L. Sp. 666. *Brassica campestris* var. *Rapa* (L.) Hartm.

214. *Raphanus*, Rettich, iii, 196 [vel errore 201]; C.K. ii. p. xlviii, fig. sinistra. *Raphanus major orbicularis, vel rotundus* C.B.P. 96. *Raphanus sativus* L. Sp. 669.

215. *Siser*, Geirlin, iii, 198; C.K. ii, p. xliv.—The figure purports to represent Skirret, *Sium Sisarum* L., but cannot be that species, as the leaves are quite unlike. It resembles Salsify, *Tragopogon porrifolius* L. Moretti regarded the figure as fictitious.

216. *Brassica*, Koel, Kappeskraut, iii, 199; C.K. ii, p. l. *Brassica capitata alba* C.B.P. 111. *Brassica oleracea* var. *capitata* L. Sp. 667.

217. *Triticum*, Weysszen, iii, 201 [vel errore 196]; C.K. ii, p. liv. *Triticum hybernum aristis carens* C.B.P. 21. *Triticum hybernum* L. Sp. 86.

218. *Siligo*, Rocken, iii, 203; C.K. ii, p. lvi. *Secale hybernum vel majus* C.B.P. 23. *Secale cereale* L. Sp. 84.

219. *Avena*, Haberen, iii, 205; C.K. ii, p. lvii. *Avena vulgaris seu alba* C.B.P. 23. *Avena sativa* var. *β* L. Sp. 79.

220. *Zea*, Speltz, iii, 206; C.K. ii, p. lviii. *Zea dicoccos vel major* C.B.P. 22. *Triticum Spelta* L. Sp. 86.

221. *Hordeum*, Gerst, iii, 208; C.K. ii, p. lx. *Hordeum polystichum hybernum* C.B.P. 22. *Hordeum vulgare* L. Sp. 84.

222. *Faba*, Bonen, iii, 211; C.K. ii, p. lxiv. *Faba* C.B.P. 338. *Vicia Faba* L. Sp. 737.

223. *Pisum*, Erbssen, iii, 213; C.K. ii, p. lxvi. *Pisum arvense* C.B.P. 342. *Pisum sativum* L. Sp. 727.

224. *Lens*, Lynssen, iii, 214. *Lens vulgaris* C.B.P. 346. *Ervum Lens* L. Sp. 735. *Lens culinaris* Medic.

225. *Milium*, Hyrss, iii, 216; C.K. ii, p. lxx. *Milium semine luteo vel albo* C.B.P. 26. *Panicum miliaceum* L. Sp. 58.

226. *Ervum*, Wicken, iii, 218; C.K. ii, p. lxxi. *Vicia sativa vulgaris semine nigro* C.B.P. 344. *Vicia sativa* L. Sp. 736.

227. *Papaver*, Magsomen, Magsor, iii, 220; C.K. ii, p. lxxiii. *Papaver hortense semine albo sativum* C.P.B. 170. *Papaver somniferum* L. Sp. 508.

228. Frawen roeszlin, C.K. pp. xcvii, clxxxv. *Lychnis Coronaria* (L. Sp. 436) Desr.

229. *Lilium*, Weissz Gilgen, C.K. p. cii. *Lilium album flore erecto et vulgare* C.B.P. 76. *Lilium candidum* L. Sp. 302.

230. *Iris*, Blaw Gilgen, C.K. p. cxii. *Iris vulgaris Germanica sive sylvestris* C.B.P. 30. *Iris germanica* L. Sp. 38.

231. Edler Hanenfuossz, C.K. p. cxxviii. *Geranium pyrenaicum* N. L. Burm.—Identified by Moretti and Bubani (Fl. Pyren. iii, 319), with *Geranium columbinum* L. Sp. 682, but the flowers, and especially the petals, are too large, and the cutting of the leaves is very different.

232. *Chamomilla*, Chamillen, i, 252 (text); C.K. p. cxxxvi. *Chamæmelum vulgare, Leucanthemum Diosc.* C.B.P. 135. *Matricaria Chamomilla* L. Sp. 891.

233. *Morsus gallinæ major* [C.B.P.], Grosz Vogelkraut, C.K. p. ccxiv, fig. sinistra. *Stellaria aquatica* (L. Sp. 439) Scop.—Cited by C. Bauhin (Pinax, 250) under his *Alsine altissima nemorum*, which is a synonym of *Stellaria nemorum* L. Sp. 421.

234. *Morsus gallinæ minor* [C.B.P.], Klein Vogelkraut, C.K. p. ccxiv, fig. dextra. *Stellaria media* (L. Sp. 272) Vill.

235. *Esula*, Wolffsmilch, i, 194 (text); C.K. p. ccxxxiii. *Tithymalus helioscopius* C.B.P. 291. *Euphorbia Helioscopia* L. Sp. 459.

236. *Saxifraga*, Edeler Steinbrech, C.K. p. ccxxxviii. *Herniaria glabra* L. Sp. 218.—Moretti appears to have been the first to identify this figure. I had come to the same conclusion before seeing his paper.

237. *Saxifraga rubea*, *Alkakengi*, Schlutten, Boborellen, Judenkirssen, i, 188 (text); ii, 35 et iii, 15, sub voce *Solanum* (text); C.K. p. ccxlii. *Solanum vesicarium* C.B.P. 116. *Physalis Alkekengi* L. Sp. 183.

238. *Capillus Veneris*, Widerthon, Widertodt, C.K. p. ccxliii. *Polytrichum aureum minus* C.B.P. 356. *Polytrichum commune* L. Sp. 1109.—This Bauhin synonym was not cited by Linné.

239. *Catapucia*, *Granum solis*, Springkorn, Springkraut, i, 230 (text); C.K p. cclxii. *Lathyris major* C.B.P. 293. *Euphorbia Lathyris* L. Sp. 457.

240. *Filix*, Waldtfar, ed. 1540, iii, 127; C.K. p. cccv. *Polystichum* sp.—Cited by C. Bauhin (Pinax, 358) under his *Filix non ramosa dentata*, which is a synonym of *Dryopteris Filix-mas* (L. Sp. 1090) Schott. Mr. C. H. Wright suggests that it may possibly be *Polystichum aculeatum* (L.) Schott.

241. Katzentreübel maennlin, C.K. p. cccxxiii, fig. sinistra. *Sempervivum minus vermiculatum acre* C.B.P. 283. *Sedum acre* L. Sp. 432.—C. Bauhin apparently did not cite this figure of Brunfels.

242. *Sempervivum minus album* [C.B.P.], Katzentreübel weiblin, C.K. p. cccxxiii, fig. dextra. *Sedum minus teretifolium album* C.B.P. 283. *Sedum album* L. Sp. 432.

243. *Crocus*, Saffron, C.K. ii, p. xiv. *Colchicum autumnale* L.—vide nos. 176, 195.

244. *Sambucus*, Holder, iii, 181 (text); C.K. ii, p. xxx. *Sambucus nigra* L. Sp. 269.—The drawing shows a common abnormality of the Elder, namely, the confluence of a terminal leaflet with one of the uppermost pair.

245. *Allium*, Knoblauch, Knobloch, iii, 135 (text); C.K. ii, p. xxxii. *Allium sativum* L. Sp. 296.

246. Lauch, ed. 1540, iii, 136; C.K. ii, p. xxxiv, fig. dextra. *Allium ascalonicum* L. Amœn. Acad. iv, 454.

247. Ziblen, Zybelen, iii, 134 (text); ed. 1540, iii, 135 (reduced and reversed copy of the figure in C.K. ii); C.K. ii, p. xxxvi. *Allium cepa* L. Sp. 300.

248. *Sinapis*, Senff, iii, 140 (text); C.K. ii, p. xl.—Apparently a fictitious figure.

249. *Eruca*, Weisser Senff, iii, 140 (text); C.K. ii, p. xli. *Sinapis alba* L. Sp. 668.

250. Napen, C.K. ii, p. xlv.—The figure purports to represent *Brassica Napus* L., but seems to be *Daucus Carota*, L. Sp. 242.

251. *Rhaphanus agrestis*, *Armoracia*, Moerrettich, iii. 197 (text); C.K. ii p. xlviii, fig. sinistra. *Cochlearia Armoracia* L. Sp. 648.

252. *Oryza*, *Oriza*, Reisz (errore), iii, 210 (text); C.K. ii, p. lxii.—The figure purports to represent Rice, *Oryza sativa* L., but is actually Cress,

Lepidium sativum L. Sp. 644. The figure of Cress originally given (No. 134) was very poor, and the present one was doubtless intended to replace it.

253. *Cicer*, Zyszeron, iii, 217 (text); C.K. ii, p. lxvii. *Cicer arietinum* L. Sp. 738.

254. *Beta*, Roemischer Mangolt, iii, 145 (text); C.K. ii, p. lxxv. *Beta vulgaris* var. *Cicla* L. Sp. 222.

255. *Beta*, Roter Mangolt, iii, 145 (text); C.K. ii, p. lxxvi. *Beta vulgaris* var. *cruenta* Alef. Landwirthsch. Fl. 279.

256. *Vitis vinifera*, Weinreb, iii, 183 (text); C.K. ii, p. lxxxiv. *Vitis vinifera* L. Sp. 202.

257. *Ligustrum*, Harrtryegel, Hartryegel (errore), iii, 185 (text); C.K. ii, p. lxxxvii.—The figure purports to represent Privet, *Ligustrum vulgare* L., but is actually Dogwood, *Cornus sanguinea* L. Sp. 117.

258. *Prunus sylvestris*, Schlehen, iii, 186 (text); C.K. ii, p. lxxxviii. *Prunus spinosa* L. Sp. 475.

259. *Iuniperus*, Wechholder, Wegkholder, iii, 182 (text); C.K. ii, p. lxxxviii. *Juniperus communis* L. Sp. 1040.

260. *Rubus*, Bromboeren, iii, 186 (text); C.K. ii, p. xc. *Rubus fruticosus* L. Sp. 493.

261. *Branca ursina*, Baerenklaw, Boerenkloe, iii, 149 (text); C.K. ii. p. xcii.—Unidentified. Possibly a fictitious figure. The Latin and German names are those of *Heracleum Sphondylium* L.

262. *Pyrethrum*, Bertram, iii, 158 (text); C.K. ii, p. xcvi. *Achillea Ptarmica* L. Sp. 898.

263. *Dictamus*, Diptam, Wylder Poley, iii, 158 (text); C.K. ii. p. xcviii. *Dictamnus albus* L. Sp. 383.

264. *Hyssopus*, Garten Hyssop, iii, 164 (text); C.K. ii, p. cviii, fig. sinistra.—The figure purports to be Hyssop, *Hyssopus officinalis* L., but is apparently Garden Thyme, *Thymus vulgaris* L., and is repeated under that species on the very next leaf.

265. *Hyssopus agrestis*, Wylder Hyssop, iii, 164 (text); C.K. ii, p. cviii, fig. dextra. *Hyssopus officinalis* L. Sp. 569.—I am indebted for this identification to Dr. Carl Epling. The only species to which the name Wilder Isop has been applied, according to Pritzel and Jessen, is *Satureia hortensis* L., which has a very different inflorescence.

266. *Thymus*, Thymian, iii, 162 (text); C.K. ii. p. cx. *Thymus vulgaris* L. Sp. 591.

267. *Abrotanum,* Stabwurtz, iii, 163 (text); C. K. ii, p. cxii. *Artemisia Abrotanum* L. Sp. 845.

268. *Gentiana, Genciana,* Encian (errore), iii, 161 (text); C.K. ii. p. cxiv.—The figure represents *Atropa Belladonna* L. Sp. 181, though the text relates to *Gentiana lutea* L.

269. *Sion,* Bachbunn, C.K. ii, p. cxvi. *Veronica Beccabunga* L. Sp. 12—*vide* No. 202.

270. *Berberis, Spina acuta,* Saurach, Saurrauch, iii, 183 (text); C.K. ii. p. cxviii. *Berberis vulgaris* L. Sp. 330.

271. Wylde oder Welsche Bonen, C.K. ii, p. cxix.—Apparently a composite figure, consisting of *Silene vulgaris* (Moench) Garcke with a capitulum of *Cichorium Intybus* L. replacing one of the flowers—*vide* Nos. 185, 168.

272. *Angelica,* Angelica, iii, 66 (text); C.K. ii. p. cxx. *Angelica Archangelica* L. Sp. 250. *Archangelica officinalis* Hoffm.

273. *Sempervivum, Aizoum,* Hauswurtz, iii, 114 (text); C.K. ii, p. cxxxii. *Sempervivum tectorum* L. Sp. 464.

274. *Hippomarathrum,* Berwurtz, Beerwurtz, C.K. ii, p. cxxxvii. *Athamanta Meum* L. Sp. 245. *Meum athamanticum* Jacq.

275. Nept, C.K. ii, p. cxxxviii. The vernacular name Nept was applied in the 15th and 16th centuries to *Nepeta Cataria* L., and the figure might conceivably be intended to represent that species, though in that case, it is a wretched representation. Dr. Carl Epling suggests that it may be *Leonurus Marrubiastrum* L. Sp. 584.

276. *Pæonia, Peonia,* Peonien Rosen, Peonienbluom, ii, 13 (text); iii, 16 (text); C.K. ii, p. cxxxix. *Pæonia officinalis* L. Sp. 530.

277. *Lupulus,* Hopff, iii, 113 (text); C.K. ii, p. cxl. *Humulus Lupulus* L. Sp. 1028.

278. Weisse Nyeszwurtz, C.K. ii. p. cxlii.—Unidentified Composite. Possibly a fictitious figure.

279. Geyssszblatt, C.K. ii, p. cxliv.—The name Geyssszblatt applies to *Lonicera Periclymenum* L. and *L. Caprifolium* L. The figure appears to be a conventional design, in which only the twining habit and the single inflorescence at the top have been borrowed from *Lonicera.* The lower branches are reminiscent of the compound leaves of *Clematis.*

280. Wunderbaum, C.K. ii, p. cxlv. *Ricinus communis* L. Sp. 1007.

281. *Rosa,* Rosen, C.K. ii, p. cxlvi. *Rosa provincialis* Mill. Gard. Dict. ed. 8, no. 18 (1768).

282. *Rubea*, Roete, iii, 145 (text); C.K. ii, p. cxliii. *Carthamus tinctorius* L. Sp. 830.

283. *Malus*, Apfelbaum, iii, 222 (text); C.K. ii, p. cl. *Pyrus Malus* L. Sp. 479.

284. *Anisum*, Enisz, ed. 1540, iii, 105.—The figure purports to be Anise, *Pimpinella Anisum* L., but is actually a reduced and reversed copy of the figure of Fennel, *Fœniculum vulgare* Mill.—*vide* Nos. 97, 207.

285. *Sempervivum*, Hausszwurtz (errore), ed. 1540, iii, 114.—Unidentified Composite. Possibly a fictitious figure.

13. *Systematic Conspectus of Species figured.*

In order to give some idea of Brunfels's contributions to taxonomic botany, an attempt has been made to indicate which of his plants were known respectively to the ancient Greeks and Romans, and in the mediæval period, the remainder representing the plants first published by him. Many of the latter, however, were evidently well known to his contemporaries, though perhaps not previously figured or described. Of the 258 species (and varieties) in the following list, 78 were known to Theophrastus, 84 to Dioscorides, Columella, and other writers of the classical Roman period, and 49 in mediæval times, the remaining 47 being "new" in the sense that they do not seem to have been identified with any degree of certainty in previous works. Among the "new" species were such well-known plants as *Chenopodium Bonus-Henricus, Anemone nemorosa, A. Pulsatilla, Cardamine pratensis, Erophila verna, Isnardia palustris, Melampyrum arvense, Plantago media,* and *Carlina vulgaris*; and the "double" form of *Ranunculus acris* does not seem to have been previously recorded.

By the irony of fate some of the more important additions of Brunfels to the iconography of the European flora—e. g., *Anemone Pulsatilla, Cardamine pratensis,* and *Linaria vulgaris*—were included rather against his will, in order to keep the craftsmen employed, or to fill up space. The inclusion of *Isnardia palustris* was due to this species having been brought in to be drawn under the mistaken impression that it was Purslane (*Portulaca oleracea*).

Comparison of the following list with Sprengel's account of the taxonomic contributions of Fuchs shows that at least fifty species stated by him to have been first figured by Fuchs were previously figured by Brunfels; and the following nine species cited as having been first discovered in Germany by Tragus were also illustrated previously in Brunfels's works:—*Ruscus Hypoglossum, Lychnis Coronaria, Herniaria glabra, Cochlearia Armoracia, Dictamnus albus, Ægopodium Podagraria, Cornus sanguinea, Atropa Belladonna, Plantago lanceolata.*

The following abbreviations are employed to indicate the authors who previously recorded the various species :—

A. Albertus Magnus, *fide* Meyer et Jessen (**31**).
B. Apuleius Barbarus (Bodley MS.), *fide* Gunther (**21**).
C. Columella, *fide* Sprengel (**39**).
D. Dioscorides, *fide* Sprengel (**39**).
J. Juvenal, *fide* Dyer (**17**).
M. Mediæval Italian, *fide* Saccardo (**37**).
N. Nicander, *fide* Sprengel (**39**).
OS. Ortus Sanitatis (**33**).
P. Pliny, *fide* Sprengel (**39**).
R. Classical Roman, *fide* Saccardo (**37**).
T. Theophrastus, *fide* Hort and Dyer (**22**)
*. Not previously recorded.

HEPATICÆ : Marchantia polymorpha *.

MUSCI : Polytrichum commune *.

FILICALES : Asplenium Ruta-muraria (M ; OS, Capillus veneris) ; Phyllitis Scolopendrium (T) ; Polypodium vulgare (T).

EQUISETALES : Equisetum limosum (D).

GYMNOSPERMÆ : Juniperus communis (T).

ALISMACEÆ : Alisma Plantago-aquatica (D).

GRAMINEÆ : Avena sativa (T) ; Hordeum vulgare (T) ; Panicum miliaceum (T) ; Secale cereale (P) ; Triticum hybernum* ; T. Spelta (R, 4th century A.D.).

ARACEÆ : Arum maculatum (A, vi, § 290 ; OS, Aarona) ; Dracunculus vulgaris (T).

LEMNACEÆ : Lemna sp. (OS, Lenticula aquæ).

LILIACEÆ : Allium ascalonicum (R) ; A. Cepa (T) ; A. Porrum (T) ; A. sativum (T) ; A. Scorodoprasum (D) ; A. ursinum* ; Asparagus officinalis (J) ; Colchicum autumnale (D) ; Convallaria majalis (OS, Lilium convallium) ; Lilium candidum (T) ; L. croceum* ; L. Martagon (T) ; Maianthemum bifolium (P) ; Polygonatum multiflorum* ; Ruscus Hypoglossum (T, D) ; Scilla bifolia (T).

AMARYLLIDACEÆ : Leucojum vernum* ; Narcissus Pseudo-Narcissus (R).

IRIDACEÆ : Iris germanica (D) ; I. Pseudacorus (R).

ORCHIDACEÆ : Gymnadenia conopsea* ; Listera ovata* ; Ophrys fuciflora* ; Orchis militaris* ; O. morio (D) ; O. purpurea* ; Spiranthes spiralis (D).

MORACEÆ : Cannabis sativa (C, D) ; Humulus Lupulus (P).

URTICACEÆ : Parietaria officinalis (D) ; Urtica dioica (D) ; U. urens (T).

ARISTOLOCHIACEÆ : Aristolochia Clematitis (D) ; Asarum europæum (D).

Polygonaceæ: Polygonum Bistorta (OS, Colubrina); P. lapathifolium*; P. Persicaria (T); Rumex Acetosa (C, D); R. obtusifolius (D); R. Patientia (T).

Chenopodiaceæ: Beta vulgaris var. Cicla (C); B. vulgaris var. cruenta (B, t. iii; A, vi, § 292); Chenopodium Bonus-Henricus*.

Caryophyllaceæ: Agrostemma Githago (D); Dianthus carthusianorum*; Herniaria glabra (T); Lychnis Coronaria (T); Silene vulgaris (T); Stellaria aquatica*; S. media*.

Nymphæaceæ: Nuphar luteum (T); Nymphæa alba (T).

Ranunculaceæ: Anemone Hepatica (M); A. nemorosa*; A. Pulsatilla*; Delphinium Consolida (OS, Consolida regalis); Helleborus viridis (M); Pæonia officinalis (D); Ranunculus acris, flore pleno* (sp. M); R. bulbosus*; R. Ficaria (T); R. nemorosus*.

Berberidaceæ: Berberis vulgaris (P; OS, Berberis).

Papaveraceæ: Chelidonium majus (T); Corydalis cava (OS, Aristologia); Fumaria officinalis (R); Papaver Rhœas (T); P. somniferum (T).

Cruciferæ: Brassica campestris var. Rapa (T); B. Napus (C); B. oleracea var. capitata (C); Capsella Bursa-pastoris (D); Cardamine pratensis*; Cheiranthus Cheiri (T); Cochlearia Armoracia (C, D); Erophila verna*; Lepidium latifolium (D); L. ruderale*; L. sativum (T); Matthiola incana (T); Raphanus sativus (T): Sinapis alba (N, C); S. arvensis (D); Sisymbrium officinale (N); S. Sophia*.

Crassulaceæ: Sedum acre (D); S. album (M); S. Telephium (A, vi, § 402); Sempervivum tectorum (T).

Saxifragaceæ: Saxifraga granulata*.

Rosaceæ: Agrimonia Eupatoria (D); Alchemilla vulgaris (M; OS, Alchimilla); Fragaria vesca (P); Geum urbanum (P; OS, Garioffilata); Potentilla Anserina (OS, Protentilla]; P. erecta (OS, Tormentilla); P. recta var. obscura*; P. reptans (T): Prunus spinosa (R); Pyrus Malus (T); Rosa provincialis (P); Rubus fruticosus (D).

Leguminosæ; Cicer arietinum (T); Cytisus scoparius*; Glycyrrhiza glabra (T); Lens culinaris (T); Medicago lupulina*; Melilotus officinalis (D); Pisum sativum (T); Trifolium pratense (M); T. repens (M); Vicia Faba (T); V. sativa (C).

Geraniaceæ: Erodium cicutarium*; Geranium pyrenaicum*.

Oxalidaceæ: Oxalis Acetosella (OS, Alleluia).

Linaceæ: Linum usitatissimum (T).

Rutaceæ: Dictamnus albus (M; A, vi, § 327); Ruta graveolens (T).

Euphorbiaceæ: Euphorbia Helioscopia (D); E. Lathyris (D); Ricinus communis (T).

Vitaceæ: Vitis vinifera (T).

Malvaceæ: Althæa officinalis (T); Malva Alcea*; M. rotundifolia (R); M. sylvestris (T).

GUTTIFERÆ : Hypericum perforatum (D).

VIOLACEÆ : Viola hirta* ; V. odorata (T) ; V. tricolor (R).

ONAGRACEÆ : Isnardia palustris*.

ARALIACEÆ : Hedera Helix (T).

UMBELLIFERÆ : Ægopodium Podagraria* ; Apium graveolens (T) ; A. Petroselinum (T); Archangelica officinalis (M) ; Bupleurum rotundifolium (R; OS, Durchwachs) ; Coriandrum sativum (T) ; Daucus Carota (T) ; Fœniculum vulgare (T) ; Heracleum Sphondylium (D) ; Levisticum officinale (C, D) ; Meum athamanticum (A, vi, § 272) ; Peucedanum Ostruthium (OS, Astrens) ; Pimpinella Anisum (T) ; P. saxifraga (R) ; Sanicula europæa (M ; OS, Diapensia); Sium Sisarum (C).

CORNACEÆ : Cornus sanguinea (T).

PYROLACEÆ : Pyrola rotundifolia (OS, Pirola).

PRIMULACEÆ : Anagallis arvensis (D) ; A. fœmina (T) ; Primula elatior* ; P. veris (OS, Herba paralisis).

GENTIANACEÆ : Centaurium umbellatum (T) ; Gentiana Cruciata*.

APOCYNACEÆ : Vinca minor (D).

ASCLEPIADACEÆ : Vincetoxicum officinale (D).

CONVOLVULACEÆ : Calystegia sepium (T).

BORAGINACEÆ : Anchusa officinalis (M; OS, Buglossa) ; Borago officinalis (M; OS, Borago) ; Cynoglossum officinale (D) ; Echium vulgare (M) ; Myosotis palustris* ; Symphytum officinale (D).

VERBENACEÆ : Verbena officinalis (D).

LABIATÆ : Ajuga genevensis*; Glechoma hederacea (M ; OS, Edera terrestris) ; Hyssopus officinalis (D) ; Lamium album (D) ; L. maculatum (P) ; Leonurus Cardiaca (M ; OS, Cardiaca) ; L. Marrubiastrum (D) ; Marrubium vulgare (C, D) ; Melissa officinalis (T) ; Mentha Pulegium (T) ; Ocimum Basilicum (T); Origanum Majorana (T) ; O. vulgare (C) ; Rosmarinus officinalis (C, D) ; Salvia officinalis (N) ; S. pratensis (M) ; Stachys officinalis (A, vi, § 289 ; OS, Betonica); Thymus Serpyllum (C, D) ; T. vulgaris (C).

SOLANACEÆ : Atropa Belladonna (T) ; Hyoscyamus niger (R) ; Physalis Alkekengi (D) ; Solanum nigrum (T).

SCROPHULARIACEÆ : Euphrasia officinalis (OS, Eufragia) ; Linaria vulgaris (A, vi, § 336 ; OS, Linaria) ; Melampyrum arvense* ; Scrophularia nodosa (M) ; Verbascum Thapsus (D) ; Veronica Beccabunga (M) ; V. Chamædrys (OS, Gamandria) ; V. serpyllifolia* ; V. Teucrium*.

PLANTAGINACEÆ : Plantago lanceolata (T) ; P. major (T) ; P. media*.

RUBIACEÆ : Asperula odorata (B, t. xviii).

CAPRIFOLIACEÆ : Sambucus nigra (T) ; S. Ebulus (C, D).

VALERIANACEÆ : Valeriana officinalis (OS, Valeriana).

DIPSACACEÆ : Dipsacus sylvestris (R) ; Scabiosa columbaria* ; Succisa pratensis (OS, Morsus diaboli).

CUCURBITACEÆ : Lagenaria vulgaris (T).

CAMPANULACEÆ: Campanula Rapunculus (M).

COMPOSITÆ: Achillea Millefolium (M; OS, Millefolium); A. Ptarmica (D; OS, Piritrum); Anthemis Cotula (M; A, vi, § 294); Arctium minus (M); Artemisia Abrotanum (D); A. Absinthium (T); A. vulgaris (M; B, t. lxxv; OS, Arthemisia); Bellis perennis (P); Calendula officinalis (C, P); Carlina vulgaris*; Carthamus tinctorius (T); Centaurea Calcitrapa (T); C. Cyanus R; Chrysanthemum Leucanthemum*; C. Parthenium (T); Cichorium Intybus (T); Cirsium acaule (M); Hieracium Pilosella (OS, Auricula muris); Inula Helenium (T); Lactuca virosa (R); Matricaria Chamomilla (T); Onopordon Acanthium (D); Senecio Jacobæa (M); S. vulgaris (T); Silybum Marianum (T); Tanacetum vulgare (M; OS, Tanacetum); Taraxacum officinale (T); Tragopogon porrifolius (T); Tussilago Farfara (D); Xanthium strumarium (D).

14. *Index of Accepted Scientific Names of the Plants figured.*

Achillea Millefolium, 204, 205; A. Ptarmica, 262; Ægopodium Podagraria, 200; Agrimonia Eupatoria, 160; Agrostemma Githago, 85; Ajuga genevensis, 24; Alchemilla vulgaris, 116; Alisma Plantago-aquatica, 3; Allium ascalonicum, 246; A. Cepa, 247; A. Porrum, 188; A. sativum, 245; A. Scorodoprasum, 187; A. ursinum, 189; Althea officinalis, 186; Anagallis arvensis, 83: A. fœmina, 84; Anchusa officinalis, 35; Anemone Hepatica, 68; A. nemorosa, 136; A. Pulsatilla, 76, Anthemis Cotula, 88; Anthriscus Cerefolium, 192; Apium graveolens, 174; A. Petroselinum, 181; Archangelica officinalis, 272; Arctium minus, 123; Aristolochia Clematitis, 11; Artemisia Abrotanum, 267; A. Absinthium, 193; A. vulgaris, 139; Arum maculatum, 12; Asarum europæum, 17; Asparagus officinalis, 208; Asperula odorata, 94; Asplenium Ruta-muraria, 78; Atriplex sp., 137; Atropa Belladonna, 268; Avena sativa, 219.

Bellis perennis, 100; Berberis vulgaris, 270; Beta vulgaris var. Cicla, 254; B. vulgaris var. cruenta, 255; Borago officinalis, 36; Brassica campestris var. Rapa, 213; B. Napus 212; B. oleracea var. capitata, 216; Bupleurum rotundifolium, 64.

Calendula officinalis, 89; Calystegia sepium, 166; Campanula Rapunculus, 138; Cannabis sativa, 209; Capsella Bursa-pastoris, 145; Cardamine pratensis, 77; Carlina vulgaris, 125; Carthamus tinctorius, 196, 282; Centaurea Calcitrapa, 157; C. Cyanus, 201; Centaurium umbellatum, 183; Cheiranthus Cheiri, 43; Chelidonium majus, 82; Chenopodium Bonus-Henricus, 15; Chrysanthemum Leucanthemum, 90; C. Parthenium, 86; Cicer arietinum 253; Cichorium Intybus, 168, 271; Cirsium acaule, 112; Cochlearia Armoracia, 251; Colchicum autumnale, 176, 195, 243; Convallaria majalis, 72; Coriandrum sativum, 70; Cornus sanguinea, 257; Corydalis cava, 9, 10; Cynoglossum officinale, 60; Cytisus scoparius, 197.

Daucus Carota, 250; Delphinium Consolida, 21; Dianthus carthusianorum, 121; Dictamnus albus, 263; Dipsacus sylvestris, 126; Dracunculus vulgaris, 16.

Echium vulgare, 34; Equisetum limosum, 194; Erodium cicutarium, 108; Erophila verna, 105; Euphorbia Helioscopia, 235; E. Lathyris, 239; Euphrasia officinalis, 58.

Fœniculum vulgare, 97, 207, 284; Fragaria vesca, 107; Fumaria officinalis, 27.

Gentiana Cruciata, 115; Geranium pyrenaicum, 231; Geum urbanum, 111; Glechoma hederacea, 56; Glycyrrhiza glabra, 182; Gymnadenia conopsea, 33.

Hedera Helix, 92, 93; Helleborus viridis, 5; Heracleum Sphondylium, 206; Herniaria glabra, 236; Hieracium Pilosella, 179; Hordeum vulgare, 221; Humulus Lupulus, 277; Hyoscyamus niger, 79; Hypericum perforatum, 163; Hyssopus officinalis, 265.

Inula Helenium, 170; Iris germanica, 230; I. Pseudacorus, 113; Isnardia palustris, 171; Iuniperus communis, 259.

Lactuca virosa, 148; Lagenaria vulgaris, 211; Lamium album, 51; L. maculatum, 52; Lemna sp., 178; Lens culinaris, 224; Leonurus Cardiaca, 54; L. Marrubiastrum, 275; Lepidium latifolium, 180; L. ruderale, 146; L. sativum, 134, 252; Leucojum vernum, 42; Levisticum officinale, 177; Lilium candidum, 229; L. croceum, 150; L. Martagon, 149; Linaria vulgaris, 109; Linum usitatissimum, 59; Listera ovata, 63, 65; Lonicera sp., 279; Lychnis Coronaria, 228.

Maianthemum bifolium, 129; Malva Alcea, 133; M. rotundifolia, 131; M. sylvestris, 132; Marchantia polymorpha, 69; Marrubium vulgare, 55; Matthiola incana, 120; Matricaria Chamomilla, 232; Medicago lupulina, 124; Melampyrum arvense, 117; Melilotus officinalis, 152; Melissa officinalis, 158; Mentha Pulegium, 80; Mentha sp., 135; Meum athamanticum, 274; Myosotis palustris, 61.

Narcissus Pseudo-Narcissus, 41; Nepeta Cataria, 275; Nuphar luteum, 6; Nymphæa alba, 7.

Ocimum Basilicum, 71; Onopordon Acanthium, 172; Ophrys fuciflora, 31; Orchis militaris, 29; O. morio, 30; O. purpurea, 28; Origanum vulgare, 199; Oxalis Acetosella, 153.

Pæonia officinalis, 276; Panicum miliaceum, 225; Papaver Rhœas, 154; P. somniferum, 227; Parietaria officinalis, 91; Peucedanum Ostruthium, 159; Phyllitis Scolopendrium, 110; Physalis Alkekengi, 237; Pimpinella Anisum, 173; P. saxifraga, 144; Pisum sativum, 223; Plantago lanceolata, 2; P. major, 4; P. media, 1; Polygonatum multiflorum, 167; P. Bistorta, 13, 14; P. lapathifolium, 96; P. Persicaria, 95; Polypodium vulgare, 175, 184; Polystichum aculeatum, 240; Polytrichum commune, 238; Potentilla Anserina, 151; P. erecta, 22; P. recta var. obscura, 103; P. reptans, 104; Potentilla sp., 81; Primula elatior, 26; P. veris, 25; Prunus spinosa, 258; Pyrola rotundifolia, 165; Pyrus Malus, 283.

Ranunculus acris, flore pleno, 48; R. bulbosus, 49; R. Ficaria, 75; R. nemorosus, 47; Raphanus sativus, 214; Ricinus communis, 280; Rosa provincialis, 281; Rosmarinus officinalis, 122; Rubus fruticosus, 260; Rumex Acetosa, 128; R. obtusifolius, 164; R. Patientia, 198; Ruscus Hypoglossum, 169; Ruta graveolens, 162.

Salvia officinalis, 140; S. pratensis, 101; Sambucus Ebulus, 142; S. nigra, 244; Sanicula europæa, 20; Saxifraga granulata, 67; Scabiosa columbaria, 99; S. Succisa, 114; Scilla bifolia, 66; Scrophularia nodosa, 73; Secale cereale, 218; Sedum album, 242; S. acre, 241; S. Telephium, 74; Sempervivum tectorum, 273; Senecio Jacobæa, 119; S. vulgaris, 38; Silene vulgaris, 185, 271; Silybum Marianum, 127; Sinapis alba, 249; S. arvensis, 191; Sisymbrium officinale, 39; S. Sophia, 203; Solanum nigrum, 102; Spiranthes spiralis, 32; Stachys officinalis, 23; S. officinalis, flore albo, 210; Stellaria aquatica, 233; S. media, 234; Succisa pratensis, 114; Symphytum officinale var. ochroleucum, 19; S. officinale var. purpureum, 18.

Tanacetum vulgare, 87; Taraxacum officinale, 161; Thymus Serpyllum, 98; T. vulgaris 264, 266; Tragopogon porrifolius, 215; Trifolium pratense, 143; T. repens, 118; Triticum hybernum, 217; T. Spelta, 220; Tussilago Farfara, 8.

Urtica dioica, 50; U. urens, 53.

Valeriana officinalis, 141 ; Verbascum Thapsus, 156 ; Verbena officinalis, 37 ; Veronica Beccabunga, 202, 269 ; V. Chamædrys, 40 ; V. serpyllifolia, 57 ; V. Teucrium, 147 ; Vicia Faba, 222 ; V. sativa, 226 ; Vinca minor, 62 ; Vincetoxicum officinale, 106 ; Viola hirta, 46 V. odorata, 44 ; V. odorata var. β, 45 ; V. tricolor, 130 ; Vitis vinifera, 256.

Xanthium strumarium, 155.

15. *Index of Latin and German Names employed by Brunfels for the Plants figured.*

Abbissz, 114 ; Abrotanum, 267 ; Absynthium, 193 ; Acetosa, 128 ; Acorus, 113 ; Affodillus, 149 Agrimonia, 160 ; Aizoum, 273 ; Alant, 170 ; Alcea, 133 ; Alkakengi, 237 ; Allium, 187, 245 ; A. sylvestre, 189 ; Althæa, 186 ; Anagallis fœmina, 84 ; A. mas, 83 ; Andisten, 148 ; Andorn maennlin, 54 ; Andorn weiblin, 55 ; Anethum, 207 ; Angelica, 272 ; Anisum, 173 ; Anisum [errore], 170, 284 ; Antiffien, 148 : Apfelbaum, 283 ; Apium, 174 ; Aristolochia longa (ed. 1530 et 1532), 10 ; A. rotunda, 9 ; A. rotunda (ed. 1539), 11 ; Armoracia, 251 ; Aron, 12 ; Arona, 12 ; Artemisia, 139 ; Asarum, 17 ; Asparagus, 208 ; Astrantia, 159 ; Attich, 142 ; Auricula muris, 179 ; Avena, 219.

Bachbung (Bachbunn), 202, 269 ; Baerenklaw, 261 ; Baldrian, 141 : Basilicum, 71 ; Basilien kraut, 71 ; Baum Ephew, 93 ; Benedictenwurtz, 111 ; Berberis, 270 ; Bertram, 262 ; Berwurtz (Beerwurtz), 274 : Bestenau, 206 ; Beta, 254, 255 ; Betonica, 23 ; B. alba, 210 ; Betonien, 23 ; Beyfuossz, 139 ; Bibinell, 141 ; Blaw Gilgen, 230 ; Bluotkraut, 137 ; Boborellen, 237 ; Boerenkloe, 261 ; Bonen, 222 ; Borago, 36 ; Branca ursina, 261 ; Braunttattich, 8 ; Brassica, 216 ; Braun Betonien, 23 : Braunellen, 143 : Braun Fleyschbluom, 117 ; Braunwurtz, 73 ; Brenn nesszelen, 53 ; Breyter Wegrich, 1 : Bromboeren, 260 ; Brunella, 143 ; Buck, 139 ; Buglossa, 35 ; B. sylvestris, 34 ; Buphthalmus, 90 ; Burretsch, 36 ; Bursa Pastoris Maior, 145 ; B. Pastoris Minor, 146 ; Burtzelkraut, 171 ; Bylsamkraut, 79.

Calcar equitis, 21 ; Calendula, 89 ; Canabis, 209 ; Capillus Veneris, 78, 238 : Capnitis, 27 ; Capnos, 27 ; Caprifolium, 94 ; Cardo Paris (panis), 112 ; Carduus, 125, 172 ; C. albus, 127 ; C. fullonum, 126 ; Caryophyllata, 111 ; Cartamus, 196 ; Catapucia, 239 ; Cauda Equina, 194 ; Centaurea, 183 ; Chamædrys, 40 ; Chamæpitys, 147 ; Chamillea, 232 ; Chamomilla, 232 ; Cheiri, 43 ; Chelidonia, 82 ; Cherefolium, 192 ; Christwurtz, 5 ; Cicer, 253 : Clavis S. Petri, 25 ; Colubrina fœmina, 13 ; C. mas, 14 ; Consolida Maior fœmina, 19 ; C. Maior mas, 18 ; C. media, 24 ; C. regalis, 21 ; Coriander, Coriandrum, 70 ; Cotula fœtida, 88 ; Crocus, 195, 243 ; Crus Galli, 49 ; Cucurbita, 211 ; Cuminum, 190 ; Cynoglossa major, 60 ; C. minor, 61 ; C. vera, 60 ; Cynosorchis, 30.

Daubenkropff, 27 ; Daub Nesszel maennlin, 52 ; Daub Nesszel weiblin, 51 ; Dens Leonis, 161 ; Diapensia, 20 ; Dictamus, 263 ; Dipsacus minor, 125 ; Diptam, 263 ; Dondernegelin, 121 ; Dracontium maius, 16 ; Dreyfaltigkeytbluemlin, 130 ; Durchwachsz, 64 ; Durchwachsz maennlin, 63 ; Durchwachsz weiblin (ed. 1530 et 1532), 65 ; Durchwachss weiblin (ed. 1539), 63 ; Dyll, 207.

Eberwurtz, 112 ; Ebulus, 142 ; Edel Leberkraut, 68 ; Edler Augentrost, 57 ; Edler Hanenfuossz, 231 ; Edeler Steinbrech, 236 ; Einblatt, 129 ; Encian, 268 ; Endivia, 148 ; Engelfuossz, 175 ; Enis [errore], 170 ; Enisz, 173 ; Enula Campana, 170 ; Epphew, 93 ; Epffich, 174 ; Equisetum, 194 ; Erbssen, 223 ; Erdtberkraut, Erdtboerkraut, 107 ; Erdtrauch, 27 ; Erdt Weyrauch, 147 ; Eruca, 249 ; Ervum, 226 ; Eryngium, 157 ; Esula, 235 ; Eufragia, 57 ; Eufragia alba, 58 ; Eupatorium, 101.

Faba, 222 ; Fechdystel, 127 ; Fenchel, 97 ; Ficaria, 75 ; Filix, 184, 240 ; Fischmuntz, 135 ; Flachsz, 59 ; Flehkraut (Floehkraut) maennlin, 95 ; Flehkraut (Floehkraut) weiblin, 96 ;

Flores clavium, 25; Flos cuculi, 77; Flos S. Jacobi, 119; Fœniculum, 97; Fotzwein, 74; Fotzzwang, 74; Fragaria, 107; Fragaria [errore], 152; Frawen roeszlin, 228; Froeschloeffelkraut, 3; Fünffingerkraut, 81, 103; Fumaria herba, 27; Fumus terræ, 27; Fygwartzkraut, 75.

Gaenszbluomen, 90; Gamandræa, 40; Gamenderlin, 40; Garb im somen, 203; Garten Hyssop, 264; Garyophyllata, 111; Gauch ampffer, 153; Gauchbluom, 77; Gauchheyl maennlin, 83; Gauchheyl weiblin, 84; Gauchklee, 153; Geel Himmelschlüsszel, 25; Geel Hornungsbluom, 41; Geel Seehbluom, 6; Geel Violaten, 43; Geel wasser Gilgen, 113; Gefülter Hanenfuossz, 48; Geirlin, 215; Genciana, 268; Genista, 197; Gensbluom (Genszbluom), 105; Genszbappel, 131; Genszerich, 151; Gentiana, 268; Gerst, 221; Geysszbart, 200; Geysszblatt, 279; Gold Gilgen, 149; Goldtwurtz, 149; Granum solis, 239; Grosz Deschelkraut, 145; Grosz Fünffingerkraut, 103; Grosse Hundtszung, 60; Grosz Kletten, 123; Grosz Vogelkraut, 233; Gryndkraut, 38; Guldener Klee, 152; Gulden Guntzel, 24; Gundelreb, 56; Guot Heinrich, 15.

Haberen, 219; Hacketkraut, 76; Hanff, 209; Harff, 209; Harrtryegel (Hartryegel), 257; Haselwurtz, 17; Hauswurtz, 273; Hedera, 92, 93; H. terrestris, 56; Hederich, 191; Helleborus niger, 5; Hepatica, 68; Herba Benedicta, 111; Herba Fullonum, 115; Herba paralysis, 25; Herba paralysis alba, 26; Herba Roperti, 108; Herba (Sanctæ) Trinitatis, 130; Herba Simeonis, 133; Heyter Nesszeln, 50; Himmelschlüssel, 25, 26; Hippomarathrum, 274; Hirtzzung, 110; Hoher Steynbrech, 67, 152; Holder, 244; Holwurtz das maennlin, 10; Holwurtz das weiblin (ed. 1530 et 1532; C.K.), 9; Holwurtz das weiblin (ed. 1539), 11; Hopff, 277; Hordeum, 221; Huenerkoel (Huenerkoll), 98; Huenerserb, 98; Hundtsbluom, 88; Hymmelschlussel, 25, 26; Hyoscyamus, 79; Hypericum, 163; Hyrss, 225; Hyrszklee, 68; Hyrundinaria, 106; Hyssopus, 264: H. agrestis, 265.

Iacea nigra, 114; Ibisch, 186; Iecoraria, 69; Iris, 230; Iudenkirssen, 237; Iuniperus, 259; Iupitersbon, 79.

Kappeskraut, 216; Kartendystel, 126; Katzentreübel maennlin, 241; Katzentreübel weiblin, 242; Klapper Roszen, 154; Klein Deschelkraut, 146; Klein Funffingerkraut, 104; Kleine Garb, 205; Kleiner Hanfuosz, 49; Klein Hundtszung, 61; Klein Kletten, 155; Klein Masszlieblin, 100; Kleiner Sanickel, 136; Kleiner Steinklee, 124; Klein Vogelkraut, 234; Klein Zeitloesslin, 100; Kletten, 123; Knabenkraut, 29, 31, 74; Knabenkraut maennlin (ed. 1530 et 1532), 29; Knabenkraut weiblin, 33; Knoblauch (Knobloch), 187, 245; Koel, 216, Koerbelkraut, 192; Kornbluomen, 201; Kressen, 134; Kreützwurtz, 115; Krottendyll, 88; Kuchenschell, 76; Kürbsz, 211; Küwich, 190; Kyenlin, 98.

Lang Holwurtz, 10; Lapathum (Lappatum) acetosum, 128; Lappa, 123; L. maior, 123; L. minor, 155; Lappatum acutum, 164; Lauch, 246; Leberkraut, 69; Lens, 224; Lenticula aquæ, 178; Leontopodion, 116; Leucoium, 43; Levisticus, 177; Liebstoeckel, 177; Ligustrum, 257; Lilium, 229; L. convallis, 72; L. convallium, 72; L. rubrum, 150; L. sylvestre, 72; Lingua cervina, 110; Linsomen, 59; Linum, 59; Liquiricia, 182; Lupulus, 277; Lychnis agria, 201; Lynkraut, 109; Lynssen, 224.

Madelgeer (Magdelgeer), 115; Magsomen (Magsor), 227; Malus, 283; Malva, 131; M. equina, 132; Maunstrew, 157; Marrubium fœmina, 55; M. mas, 54; Masszlyeblin, 100; Matricaria, 86; Maur Epphew, 92; Maurrauten, 78; Maurrut, 78; Meisterwurtz, 159; Melilotum, 124; Melilotum majus, 152; Melilotum minus, 124; Melissa, 158; Mengelwurtz, 164; Menta, 135; Mentha rubea, 135; M. aquatica, 135; Mercurialis altera, 15; Mertzenbluemlin, 66; Mettram, 86; Meüszoerlin, 179; Meyenbluemlin, 72; Milium, 225; Millefolium album, 204; Millefolium in semine, 203; Millefolium parvum, 205; Moerlynssen, 178; Moerrettich, 251; Morsus Diaboli, 114; Morsus gallinæ major, 233; Morsus gallinæ minor, 234; Muotterkraut, 158.

Nachtschatt, 102; Napen, 250; Napi, 212; Narcissus [albus], 42; N [luteus], 41; N. Martius, 66; Nasturtium, 134; Naterwurtz maennlin, 14; Naterwurtz weiblin, 13; Negelbluemlin, 120; Negelkraut, 120; Nenufar fœmina, 7; Nenufar mas, 6; Nept, 275; Nigella, 85; Nopen, 212; Noterwurtz, *vide* Naterwurtz; Nyeswurtz, 5.

Ochszenzung, 35; Oculis bovis, 90; Odermeng, 160; Origanum, 199; Oryza (Oriza), 252; Osterlucey, 11.

Pæonia, 276; Papaver, 227; P. rubrum, 154; Parietaria, 91; Pastinaca, 206; Pentaphyllon, 81; P. maius, 103; P. minus, 104; Peonienbluom (Peonien Rosen), 276; Perfoliata fœmina, 65; Perfoliata mascula, 63; Perfoliata vera, 64; Pes corvi flore pleno, 48; Pes corvi primus, 47; Pes Leonis, 116; Peterlin, 181; Petroselinum, 181; Pfaffen pint, 12; Pfefferkraut, 180; Pfrymmen, 197; Pimpinella, 144; Piperitis, 180; Pisum, 223; Plantago aquatica, 3; P. maior, 1; P. minor, 2; P. rubea, 4; Poley, 80; Polypodium, 175; Porrum, 188; Portulaca, 171; Potentilla, 151; Premulæ Veris bulbus, 176; Prunus sylvestris, 259; Pulegium, 80; Pulicaria fœmina, 96; P. mascula, 95; Pycnocomos, 200; Pyrethrum, 262; Pyrola, 165.

Quendel, 98.

Ragwurtz, 30; Rapa, 213; Rapistrum, 191; Raponeoli, 138; Rapuntzlin, 138; Rattenbluomen, 85; Raurten, 162; Raut, 162; Regenwurmlin, 136; Reisz, 252; Rettich, 214; Reynfarn, 87; Rhabarbarum, 198; Rhaphanus, 214; Rhaphanus agrestis, 251; Rheubarb, 198; Ringelbluom, 89; Ringelbluemlin, 89; Rittersporen, 21; Rocken, 218; Roemischer Mangolt, 254; Roete, 282; Ronde Holwurtz, 9; Rosa, 281; Rosen, 281; Rosmarin, Rosmarinus, 122; Rosszbappelen, 132; Rosszhuob, 8; Rote Buck, 139; Rote Gilgen, 150; Roter Mangolt, 255; Rot Wegrich, 4; Rubea, 282; Ruob, 213; Rubus, 260; Ruta, 162.

Saewdistel, 125; Saffron, 195, 243; Salbey, 140; Salvia, 140; Sambucus, 244; Sanamunda, 111; Sanct Jacobs bluom, 119; Sanct Johanns Blum, 90; S. Johanns Kraut, 163; S. Peters kraut, 91; Sanguinaria, 137; Sanickel, 20; Sanicula, 20; S. maior, 20; S. minor, 136; Satyrion fœmina, 33; Satyrion mas, 29; Satyrion odoriferum, 32; Satyrion primum, 28; Satyrion quartum, 31; Saurampffer, 128; Saurauch (Saurrauch), 270; Sawbon, 79; Saxifraga (Saxifragia), 67, 236; S. rubea, 237; Scabiosa, 99; Scabiosz, 99; Schafftenhaw, 194; Scheysszkraut, 109; Schlaffkraut, 79; Schlangenkraut, 16; Schlehen, 258; Schlutten, 237; Schoelkraut, 82; Schoelwurtz, 82; Schwalbenwurtz, 106; Schwerbel, 15; Scolopendrium (Scolopendrion), 110; Scrophularia maior, 73; S. media, 74; S. minor, 75; Sempervivum, 273; S. minus album, 242; Senff, 248; Serpillum, 98; Sigillum Salomonis, 167; Sigmarswurtz, 133; Siligo, 218; Sinapis, 248; Sion, 202, 269; Siser, 215; Smilax, 185; Solanum, 102; Solidago, 100; Solsequium, 168; Sonnenwurbel, 161; Spargen, 208; Speltz, 220; Spina acuta, 270; Spitzer Wegerich, 2; Springkorn, 239; Springkraut, 239; Stabwurtz, 267; Steinklee, 124; Stendelwurtz, 28; Storkenschnabel, 108; Suesszholtz, 182; Synnaw, 116.

Tag und nacht, 91; Tanacetum, 87; Taub Nesszelen weissz, 51; Tausent guldin kraut, 183; Teüffels Abbissz, 114; Thymian, Thymus, 266; Tormentill, Tormentilla, 22; Trifolium acetosum, 153; T. album, 118; T. maius, 117; Triticum, 217.

Ungula caballina, 8; Unifolium, 129; Unser frawen bettstro, 98; Unser frawen dystel, 172; Unser Frawen Mantel, 116; Urtica labeo fœmina, 51; U. labeo mas, 52; U. maior, 50; U. minor, 53; Uvularia, 169.

Valeriana, 141; Verbascum, 156; Verbena fœmina (ed. 1530 et 1532), 38; V. fœmina (ed. 1539; C.K.), 39; V. mascula, 37; Vinca pervinca, 62; Viola alba, 45; V. sativa, 44; V. sylvestris, 46; Vitis vinifera, 256; Volubilis, 166.

Waldtfar, Waldtfaren, 184, 240; Waldtmeister, 94; Walwurtz maennlin, 18; Walwurtz weiblin, 19; Wasser Hanenfuossz, 47; Wasszer Wegerich, 3; Wechholder (Wegkholder), 259; Wegwart, 168; Weinreb, 256; Weisszer Augentrost, 58; Weissz Betonien, 25, 210; Weyssz Fleyschbluom, 118; Weiss Garb, 204; Weissz Gilgen, 229; Weissz Hornungsbluom, 42; Weissz Hymmelschlüssel, 26; Weisse Nyeszwurtz, 278; Weissz Seehbluom, 7; Weisser Senff, 249; Weissz Violaten, 45; Weisszwurtz, 167; Welsche Bonen, 185, 271; Wermuot, 193; Weysszen, 217; Wicken, 226; Widerthon, Widertodt, 238; Wilde Boley, 98; Wilde Bonen, 185, 271; Wilder Durchwachsz maennlin, 63; Wilder Durchwachsz weiblin (C.K.), 65; Wilder Hyssop, 265; Wilder Knoblauch, 189; Wilder Lauch, 188; Wild Ochszenzung, 34; Wilder Poley, 263; Wilder Saffron, 196; Wild Salbey, 101; Wilder Sanickel, 136; Wilde Violaten, 46; Wintergruen, 165; Wolffsmilch, 235; Wolgemuet, 199; Wolschmackend Knabenkraut, 32; Wullkraut, 156; Wunderbaum, 280; Wundtkraut, 74; Wyld, *vide* Wild; Wynd, 166.

Ybisch, 16; Yngryen, 62; Yszenkraut maennlin, 37; Yszenkraut weiblin (ed. 1530 et 1532), 38; Yszenkraut weiblin (ed. 1539; C.K.), 39.

Zamme violaten, 44; Zapflin kraut maennlin, 169; Zea, 220; Zeitloesslin, 100; Zeitloesslin bluom (und wurtzel), 176; Ziblen (Zybelen), 247; Zyszeren, 253.

SUMMARY OF CONTENTS.

1. *Previous Identifications of Brunfels's Plants* by Caspar Bauhin, Sprengel, Moretti, and Kirschleger (p. 79).
2. *Life of Brunfels*, 1489–1534, A.D. (p. 80).
3. *Preparation of the Herbal.* Text prepared first. Occasional lack of correspondence between text and figures. Acceptance of current nomenclature (p. 81).
4. *Sources of the Text.* It consists mainly of extracts from Dioscorides and other classical writers, the Arab physicians, and the Italian botanists of the fifteenth and early sixteenth centuries (p. 82).
5. *The Draughtsmen of the 'Vivæ Eicones.'* From internal evidence it appears that the figures were executed under the supervision of Hans Weyditz by a staff of several draughtsmen and engravers (p. 83).
6. *Nomenclature.* Frequent absence of a distinction between accepted names and synonyms (p. 84).
7. *Taxonomy.* Acceptance of current classification. Diagnostic characters of a few selected genera (p. 84).
8. *Superstition and Fable.* The transmutation of the Daffodil and the Snowflake into the Autumn Crocus and back again (p. 86).
9. *The Terms "Male" and "Female."* Brunfels's use of these terms frequently indicated differences in the colour of the flowers between two plants which seemed otherwise similar. "Male" in other cases denoted a complete, normal, or genuine kind, in contrast to "female," which was incomplete, abnormal, or spurious (p. 87).
10. *Garden Flowers.* About sixteen were mentioned by Brunfels, several being used for garlands (p. 88).
11. *The Scientific Value of the Herbal.* It affords clues to the identity of many mediæval plants, contains numerous new species, and includes many figures which may be regarded as the historic types of Linnean species (p. 88).
12. *Identifications of the Figures.* To each different figure is assigned a special running number, under which the Brunfelsian names, principal references, and modern identification are given (p. 90).
13. *Systematic Conspectus of Plants figured,* with an indication in each case whether the plant was known in classical or mediæval times (p. 113).
14. *Index of Accepted Scientific Names of the Plants figured* (p. 117).
15. *Index of Latin and German Names employed by Brunfels for the Plants figured* (p. 119).

I desire to tender my hearty thanks to all those who have afforded assistance in various ways during the preparation of the paper, and especially to my son, George Martin Sprague, who collated the references to the figures, added the names used by Caspar Bauhin, and prepared the two indexes. To Dr. Otto Stapf, F.R.S., I am indebted for the interpretation of difficult passages in the sixteenth century German text of the 'Contrafayt Kreüterbuoch, and for his kindly help in other directions. Mr. S. A. Skan has supplied various bibliographical references, while Mr. V. S. Summerhayes and Dr. Carl Epling have contributed identifications of Orchidaceæ and Labiatæ respectively. My thanks are also due to Dr. A. B. Rendle, F.R.S., and the staff of the Department of Botany, British Museum, and in particular to Mr. J. Ardagh, for facilities in examining and identifying the figures in the rare 'Ander Teil des Teütschen Contrafayten Kreüterbuoch.'

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On Charophyta collected by Mr. Thomas Bates Blow, F.L.S., in Madagascar. By JAMES GROVES, F.L.S.

(PLATES 4-7.)

[Read 12th May, 1927.]

THE following notes relate to a large collection of Charophytes made by Mr. Blow during a visit to Madagascar in the early part of 1924. The collection consists of 384 dried specimens, under 104 numbers, supplemented by a considerable number of portions of the plants preserved in formalin.

In the past these plants have, in the more remote and little-worked parts of the world, been picked up casually by collectors of Flowering Plants, rather than searched for, and the specimens are often poor and badly preserved. Mr. Blow's specimens were all carefully floated out, and, wherever possible, fruiting examples were obtained.

His principal object in visiting the island was to investigate its Charophyte-flora, and the collection he made is of great value as affording negative as well as positive evidence. His experience as a hunter of these plants far away exceeds that of any other man, and we may feel sure that, in the districts he explored, his search was practically an exhaustive one. The absence, therefore, of representatives of some sections is of significance. There are in the collection no diœcious species, either of *Nitella* or *Chara*, no heteroclemous Nitellas, and no diplostichous diplostephanous Charas. A representative of the latter group, the almost world-wide *C. vulgaris*, was collected by Douillot in another part of the island.

The greater part of Mr. Blow's sojourn in Madagascar was spent in exploring the eastern-central part of the island. The journeys undertaken were roughly as follows:—

1. Along the coast-line from north of Tamatave (Vohidrotra) to Andevorante, where there were long stretches of marshes and large lagoons.
2. Westward from Ambila, by Moramanga to Tananarive, the capital, and still further west as far as Lac Itasy (1330 m.), surrounded by a wonderful panorama of mountains.
3. Northward from Moramanga, by Atondrazaka and Andreba to Imerimandroso on Lac Alaotra (800–900 m.), with extensive marshy tracts on the western and narrow marshes along the eastern margin.

4. North of the capital to Ambohidratrimo and Ambohimanga.
5. South of the capital, by Ambatolampy to Antsirabe (1500 m.), near which are two largish lakes in the immediate neighbourhood of the very fine garden-city sanatorium, built by the French, with hot springs of mineralised waters.

On the north-east coast, Mr. Blow visited Majunga, situated on a bay running far inland surrounded by flattish country, and the island of Nosy Be. The latter was not productive of Charophytes.

In the extreme north he visited Diego Suarez, situated on probably one of the finest harbours in the world, with hilly country around.

The most productive of the parts visited were:—the coastal region from Andevorante to Tamatave; Moramanga; the neighbourhood of Tananarive; Lac Itasy; near Ambatolampy; and Lac Alaotra.

The species of *Chara* do not call for much comment. There is the world-wide *C. fragilis*, the rest are widely distributed tropical and sub-tropical species, with the exception of *C. pseudo brachypus*, so far known only from Africa. The Nitellas are much more complicated. The very distinct *N. acuminata* is found in the warmer regions of both hemispheres, *N. furcata* occurs in India, Ceylon, Burma, Malaya, and North Australia, with sub-species or allied species in Japan, Mauritius, and West Africa. Then there is a tangled series of plants very nearly allied to species occurring in Europe and elsewhere, *N. mucronata*, *N. gracilis*, and *N. tenuissima*, but differing in some characters, and which may be treated as varieties or "small species." There is another tangle of more or less nearly related types, having the fruiting whorls enveloped in a cloud of mucus, which show an affinity with Indian, African, and New Zealand species. A very distinct and remarkable plant, having the mucous envelope, is dedicated to the finder.

Mr. Blow desires to express his grateful thanks to all those who rendered assistance in connexion with his visit to Madagascar, without which it would have been impossible to traverse the districts he explored in the time at his disposal; especially to Sir John Pilter and Monsieur Philippe Crozier, of Paris, whose representations to the authorities in Madagascar led to greatly appreciated help; to the Governor of Madagascar and the French and native local Administrators, who most courteously afforded him every facility and assistance in travelling over difficult country, exploring the lakes &c.; to the President of the Academy of Madagascar; and to Mr. and Mrs. Albert Pim, the late Dr. Moss, the Rev. Joseph Radley, the Rev. F. Fairbairn, and the Rev. John Rakato, to all of whom he was much indebted for kindness and hospitality.

The very characteristic drawings illustrating this paper are the work of my sister, Miss Mary Groves. To these Canon Bullock-Webster has kindly contributed figures of the oospore-membranes.

NITELLA Agardh (emend. Leonhardi).

1. N. ACUMINATA Braun in Hooker's Journ. Bot. i, p. 292 (as var. BELLANGERI), 1849.

Moramanga, Feb. 21 (15); Tananarive (Antananarivo), Feb. 24 (25); Ambatolana Station, Feb. 23 (26); Amboimandroso, Mar. 1 (39); Antsirabe, Mar. 3 (40); Lac Andraikiba, near Antsirabe, Mar. 14 (43); Ambatolampy, Mar. 6–8 (46); about 40 km. east of Tananarive (on Tamatave Road), Mar. 10 (53); Imerintsiatosika, Mar. 12 (56); region of Lac Itasy, Mar. 13 (61, 62); marshes of Lac Alaotra, Mar. 22–23 (67); Ambatomafana, Mar. 24 (68–69); near Andevorante, Mar. 29–30 (92).

These represent a considerable range of forms, differing in stature, stoutness (diam. of stem c. 400–700 μ), relative length of primary and secondary rays (the latter less than $\frac{1}{3}$ to more than $\frac{1}{2}$ the length of the former), and the density or diffuseness of the fertile whorls. In the size of the fruit there is not much variation, the length of the oospore being about 300–350 μ, the breadth about 275–325 μ.

N. acuminata is widely distributed in the tropical and subtropical regions of both hemispheres, and in North America reaches as far north as New York State. Though evidently the commonest species of *Nitella* in Madagascar and Mauritius, it has only recently been recorded from a single locality on the African continent.

2. N. MUCRONATA Miquel var. MOBILIS nov. (Pl. **5**. figs. 7–8; Pl. **7**. fig. 5.)

Anjeva, Feb. 26 (31).

Cellulæ ultimæ dactylorum conformatione valde variantes, aliæ breviter conicæ, aliæ multo elongatæ.

Differs from the type in the wide variation in the length and shape of the ultimate cell of the dactyl, the elongated forms being the more frequent (see Pl. **5**. figs. 7–8). The apex of the lower cell is rounded as in the type, the dactyls are subequal and rarely 3-celled, the secondary rays are shorter than the tertiary and quaternary, the oogonia (as far as observed) solitary, the oospores warm dark brown, showing usually eight broadly-flanged ridges, the membrane red-brown, finely reticulate (10–12 meshes between the ridges), with very broad threads.

3. N. INÆQUALIS sp. n. (Pl. **4**. figs. 1–7; Pl. **7**. fig. 6.)

Region of Lac Alaotra, Mar. 25 (110).

Homœoclema, arthrodactyla, conoteles, subflabellata, gymnocephala, monœcia. Ramuli verticillorum 6–7, fertiles partim ter-furcati, radii ad nodum idem valde inæquales, dactyli longitudine valde inæquales partim elongati

2-cellulati, partim brevissimi 1-cellulati, cellula ultima conica, ad basim contracta.

Stem about 400 μ in diam. Branchlets 6–7 in a whorl, the sterile once- and partially twice-furcate, fertile branchlets twice- and partially thrice-furcate (the primary ray usually rather less than half their length), producing at the first node 4–5 very unequal (secondary) rays, of which 1–2 are sometimes simple, at the second node 3–4 very unequal (tertiary) rays, of which 1–2 are usually again forked, with 3–4 (quaternary) rays. Dactyls 1–2-celled, the lower cell, when present, rounded-truncate at the apex, the upper usually contracted at the base, variable in length, the 2-celled more or less elongated, the 1-celled very short.

Monœcious oogonia usually solitary, occasionally geminate, produced at the first and second nodes, less commonly at the third, c. 425–475 μ long, 325–350 μ broad, the spiral cells lengthening considerably at the apex; coronula c. 60 μ broad, 40 μ high. Oospore golden-orange to warm brown, c. 265–290 μ long, 250–280 μ broad, 200 μ thick, showing about seven low ridges, terminating in a tall (c. 90 μ) crest, membrane very tough, warm brown, finely and angularly reticulate. Antheridia c. 275 μ in diam., produced at the first and occasionally at the second node.

The specimens show a rather small plant, with tufted growth, a number of stems arising from a much thickened node at the base.

The outstanding features are: the unequal length and complexity of the rays, which are usually curved at their base, so that the tips often approach or even cross one another; the frequent presence of clusters of three short 1-celled dactyls at the second and third branchlet-nodes; the conspicuously contracted base of the ultimate cell; and the marked lengthening of the spiral cells of the oogonium.

In the specimens examined the antheridia were comparatively scarce, while oogonia were abundant. The older sterile parts are much infested with algæ, the fruiting whorls being on shoots evidently of another season's growth

4. N. GRACILIFORMIS sp. n. (Pl. 4. figs. 8–12; Pl. 7. fig. 4.)

Moramanga, Feb. 21 (17); Nemehana, Feb. 29 (37 *a*); about 40 km. east of Tananarive, on Tamatave Road, Mar. 10 (54); marshes of Lac Alaotra, Mar. 22–23 (73, 78, 80); region of Lac Alaotra, Mar. 25 (79); in Lac Itasy, Mar. 13 (64); Anjeva, Feb. 26 (29). The following also probably belong here, but are immature:—Tamatave, Feb. 16 (6); Anovorano, Feb. 19 (13); Ambatomafana, Mar. 24 (70); region of Lac Alaotra, Mar. 25 (77).

Arthrodactyla (normaliter bicellulata) homœoclema conoteles gymnocephala monœcia. Ramuli verticillorum 6, bis- et partim ter-furcati; cellula dactyli ad apicem leviter fastigata. Oogonia solitaria; coronula persistens. Oospora aureo- vel hebeti-flava; membrana tenuis, subtiliter reticulata.

Branchlets six in a whorl, twice- and partially thrice-forked, the primary rays not usually more than half the total length of the branchlet, often much less; producing at the first node 5–8 rays, at the second and third 3–4. Dactyls unequal, rarely exceeding in length the penultimate ray, 2- rarely 3-celled, the lower cell usually tapering at the apex, the upper narrow, conical.

Monœcious. Gametangia produced at the second and third nodes, often together. Oogonia solitary, c. 350–375 μ long, 300–325 μ broad; coronula c. 65 μ broad, 40 μ high, the upper cells not much elongated. Oospore light golden to dull medium yellow, c. 275–325 μ long, 250–300 μ broad, 175–200 μ thick, showing 7–8 thin ridges, usually low and not terminating in a crest; membrane very thin and transparent, finely reticulate with about 10–12 meshes between the ridges. Antheridium c. 275 μ in diam.

The plants enumerated above represent a wide range of variation as regards habit, length of branchlets, diameter of stem and branchlets, and other minor points, but I have not been able to find any sufficiently important characters to distingush them. The variation is much the same as in our European *N. gracilis*, which these plants much resemble—indeed, were it not for the important difference in the decoration of the membrane, they might well be placed under that species. The final nodes being fertile, and there being rarely any very short dactyls, separate them from *N. oligospira*. In nos. 79 and 80 the oospore-ridges are slightly flanged and crested. No. 64 is much more slender than any of the others.

Two doubtful plants, no. 75 (Moramanga, Mar. 19) and no. 102 (Tamatave, Apr. 2), are allied to, but do not agree entirely with, the above. Both are partially four times forked and have a curious reticulate-striate oospore-membrane (see Pl. 7. fig. 7). No. 75 is an extremely slender plant, and has 5–6 rays at the second and third nodes. No. 102 has the first node often fertile, and the lower dactyl-cell very gradually tapered at the apex.

5. N. TENUISSIMA Kütz. var. CALLISTA nov. (Pl. 7. fig. 8.)

Tananarive, Feb. 25 (22); Nemehana, Feb. 29 (37); Ambatolampy, Mar. 3 (49). No. 18, from Moramanga (Feb. 21), and no. 32 from Anjeva (Feb. 26) are probably the same, but are in poor condition.

Differt a typo oogoniis ad nodum primum frequenter gestatis, membrana oosporæ subtiliter reticulata, angulis macularum nodosis prominentibus, dactylis subtilissimis.

An extremely graceful slender plant, resembling the European form in structure, but with unusually thin dactyls (the diameter of the lower cell sometimes less than 25 μ), oogonia frequently produced at the first branchlet-node, and a finely reticulate oospore-membrane (Pl. 7. fig. 8). The upper cell of the dactyls is often very long and slender.

6. N. SPHÆROCEPHALA sp. n. N. LEPTOCLADA Braun, pro parte? (Pl. 5. fig. 1–6; Pl. 7. fig. 3.)

Moramanga, Feb. 22 (20, 21); Ambatolampy, Mar. 6–8 (51–52); on Tamatave Road, about 40 km. east of Tananarive, Mar. 10 (55); Imerintsiatosika, Mar. 12 (58); region of Lac Itasy, Mar. 13 (65).

Homœoclema, arthrodactyla (plerumque tri-cellulata), conoteles, subflabellata, glœocephala, monœcia. Heteromorpha; verticilli steriles laxi ramulis elongatis; fertiles plerumque congesti, ramulis brevissimis, capitula densa (sæpe fere globosa) formantes, nube dense mucosa circumfusa. Ramuli 6–8, steriles plerumque bis-furcati, fertiles bis- et sæpe partim ter-furcati. Oogonia sæpe geminata. Oospora c. 325–400 μ longa, 300–350 μ lata, 200–250 μ crassa; membrana subtiliter èt angulariter reticulata.

Stem →c. 500 μ in diam. Branchlets 6–8 in a whorl. Whorls usually conspicuously heteromorphous, the sterile and sometimes the lower fertile lax, the branchlets twice-, often partially thrice-forked, the primary rays from less than ½ to ⅔ the length of the branchlet, secondary rays 4–5, tertiary 3–4; the upper fertile whorls usually condensed, often forming almost spherical heads, enveloped in a dense cloud of mucus, of 6–8 short branchlets, twice- and often partially thrice-forked, with 3–4 rays at each forking, the rays diminishing successively in length. Dactyls mostly 3-celled, a few 2-celled, the intermediate cell, in the former, shorter and narrower than that below it, and tapering at the apex to the long conical end-cell; in some of the lower sterile whorls the dactyls very short, forming an inconspicuous crest to the penultimate rays.

Monœcious. Gametangia produced at the first and sometimes at the second node. Oogonia frequently geminate, sometimes 3 together, c. 475–550 μ long (excl. cor.), 400–450 μ broad; coronula c. 65 μ broad, 50 μ high. Oospore orange-yellow to rather cold brown, c. 325–400 μ long, 300–350 μ broad, 200–250 μ thick, showing eight thin but well-marked ridges; membrane thin, angularly reticulate, about 7–10 meshes between the ridges. Antheridia →c. 325 μ in diam.

A medium-sized plant, variable in habit. In what appears to be the typical form, the small dense roundish fertile heads, enveloped in a thick cloud of mucus, in marked contrast to the diffuse lower whorls (measured up to 45 mm. diam.), give it a distinctive appearance, but in some forms this difference is less marked, the fertile more nearly resembling the sterile whorls. The 3-celled dactyl seems to be the normal condition; in no. 65, of 112 dactyls examined, 98 were 3-celled, 14 2-celled. No. 51 is a very diffuse form. The very short dactyls on some of the lower branchlets resemble those of *N. translucens*, but in the present species these branchlets are twice forked. *N. leptoclada* was founded by Braun (Monatsb. Akad. Berl. for 1867, p. 880, 1868) on two plants collected by Welwitsch in Angola, nos. 495 & 499. The description follows that of *N. translucens*, to which species Braun likens it, adding that were it not for the gelatinous covering to the fruiting organs he would have regarded it as a variety of that species. Both numbers wêre represented in the British Museum Herbarium. No. 495 is much like *N. translucens*, and is evidently the plant intended. No. 499, on the other hand, seems to be a different plant, does not correspond with the description, and is so much unlike *E. translucens* that I think two distinct plants must have been inadvertently sent out under the same number. Some of the specimens of Mr. Blow's plants are almost identical with the Welwitsch specimen no. 499 alluded to.

7. N. VERMICULATA sp. n. (Pl. **5**. figs. 9–13 ; Pl. **7**. figs. 1–2.)

Ambila, Feb. 18 (10, 11) ; between Ambila and Andevorante, Mar. 27 (83), Apr. 1 (96, 97).

Homœoclema, arthrodactyla (constanter bicellulata), conoteles, subflabellata, glœocephala, monœcia, heteromorpha. Ramuli verticillorum 7–8, bis- et sæpe partim ter-furcati. Oogonia plerumque ad nodum secundum et tertium (nonnunquam ad primum) posita, antheridia ad nodum primum et secundum posita, sed antheridia et oogonia fere semper sejuncta. Oospora purpureo-brunnea, membrana granulata, granulis in figuris vermiformibus dispositis.

Branchlets 7–8 in a whorl, twice forked, with one, rarely two, of the tertiary rays again forked, the sterile and sometimes the lower fertile whorls lax, the upper fertile whorls with very short branchlets and enveloped in a cloud of mucus. Rays at first forking 6–8, of which 1–3 are sometimes simple; at the second 4–6; at the third 3–6. Dactyls about equal in length, uniformly 2-celled, the lower cell narrowed to the base of the upper cell, upper cell small (60–90 μ long, 15–25 μ broad at base), elongate-conical acute.

Monœcious. Oogonia solitary, at the second and third and occasionally at the first nodes, antheridia at the first and second nodes, but the two ♂ and ♀ gametangia not produced at the same node. Oogonium c. 450–500 μ long (cor. excl.), 350–400 μ broad, coronula c. 60 μ broad, 30 μ high. Oospore dark purplish brown, 300–350 μ long, 275–325 μ broad, 175–200 μ thick, showing 7–8 strong ridges ; membrane interruptedly granulate, the granules in vermiform groups more or less at right angles to the ridges. Antheridium c. 275 μ in diameter.

A medium-sized plant, in what is apparently the normal form, the small upper whorls becoming distant, and presenting a marked contrast to the lower whorls having long slender branchlets. In no. 10 the heteromorphous character is less evident. In no. 83 the granules of the oospore are more scattered. Nearly allied to the New Zealand species, *N. leptosoma* Nordst., but differing in the partial forking of the secondary rays, the larger antheridia, and the decoration of the oospore-membrane. Nos. 10, 11, and 83 are much more robust than Nos. 96–7, which latter more closely resemble the New Zealand plant in habit.

8. N. LEPTODACTYLA J. Groves var. MEGASPORA nov.

Moramanga, Feb. 21 (16); Ambohidratrimo, Feb. 28 (35); Ambatolampy, Mar. 6–8 (50); region of Lac Itasy, Mar. 13 (63); near Andevorante, Mar. 29–30 (91); Tamatave, Apr. 2 (101); Ankarefo, near Tamatave, Apr. 2 (108).

Differt a typo fructu multum majore, oospora c. 275–400 μ longa, 225–325 μ lata, atro-brunnea vel purpureo-brunnea fere atra.

With some doubt I place this series of plants under *N. leptodactyla.* Though showing a considerable range of variation, they do not seem to differ in any important point, and agree fairly well with the Ceylon plant, upon which the species was founded. The latter I described as gymnocephalous, but have since detected a trace of mucus in some of the younger whorls. The Madagascar plants have stouter stems (diam. c. 375–425 μ), the branchlet-rays rather more numerous, and, in the sterile whorls, more rigid, the fruits much larger, and the oospores darker, sometimes purplish brown almost black. The apex of the lower cell of the dactyls is sometimes rounded, so that the upper cell appears as a mucro, sometimes tapering to the base of the upper cell. No. 5, a luxuriant but immature plant from Tamatave (Feb. 16), is evidently nearly related to this, but has quinary rays abbreviated and divergent, with exceptionally long acuminate upper cells.

9. N. FURCATA Agardh, Syst. Alg. p. 124 (1824).

Chara furcata Bruzel (1824). *N. Roxburghii* Braun (1849), not *C. Roxburghii* Braun (1835). *N. polyglochin* Braun, sens. strict.

Stream, Moramanga, Feb. 21 (14); Tananarive, Feb. 25 (23); Anjeva, Feb. 26 (30); Ambohimanambola, Feb. 27 (33); Ambatolampy, Mar. 6–8 (48); marshes of Lac Alaotra, Mar. 22–23 (71); Moramanga, Mar. 19 (72); near Andevorante, Mar. 29–30 (90); Tamatave, Apr. 2 (103).

All the above numbers belong, I think, to the one species and represent weak forms of *N. furcata.* In some the fruits are solitary. In each of the fertile plants some of the oogonia have the upper cells of the coronula more or less elongated, sometimes more than twice as long as the lower, but they are mostly connivent; only in nos. 23, 48, and 90 are they definitely spreading and present the spiky appearance characteristic of the species, and in these they are not as much elongated as in the type. Ripe oospores occur on nos. 23, 30, 33, 48, 71, and 90. They are unusually large, running up to about 350 μ long, 300 μ broad, and are yellowish to reddish brown. Nos. 14, 72, and 103 are sterile.

No. 41, a doubtful plant from Antsirabe (Mar. 3), upon which I have not been able to find any developed fruit, would seem to belong to the Brachydactylæ, having conspicuously divergent rays and often abbreviated dactyls, but the ultimate node is often fertile. The upper coronula cells never apparently being elongated, it cannot well belong to *N. furcata*. It is a small plant, with rather stout short branchlets, so that the whorls appear distant, giving it a different appearance from that species, and the dactyls are never so much abbreviated as in *N. furcata*.

10. N. Blowiana sp. n. (Pl. 6.)

Ambohidratrimo, Feb. 28 (36).

Homœoclema, arthrodactyla (constanter bicellulata), allantoteles, monœcia. Ramuli verticillorum 6, ter- et parte quater-furcati. Verticilli superiores laxi, nubibus mucosis densis circumvelati. Oospora diluto-brunnea, c. 326 μ longa; membrana irregulariter et angulariter reticulata.

Stem c. 150 μ in diam. Branchlets 6 in a whorl, three and partially four times forked. Primary rays (diam. c. 175–225 μ) usually more than half the length of the branchlets; secondary 5–6; tertiary 4–5; quaternary and quinary usually 3 (diam. c. 60–80). Dactyls uniformly 2-celled, the lower cell long cylindrical, c. 60–70 μ in diam., the upper (normally) similar, slightly thinner, and but little shorter, with a very acuminate point.

Monœcious, the gametangia produced at all the nodes, but ♂ and ♀ not seen together. Oogonia solitary, c. 500 μ long (excl. cor.), 375 μ broad; coronula, c. 65 μ broad, 40 μ high, the cells irregular. Oospore light golden brown, c. 330 μ long, 315 μ broad, 225 μ thick, showing eight firm low ridges; membrane irregularly and angularly coralloid-reticulate, with about seven meshes between the ridges. Antheridinm c. 350 μ in diam.

The most remarkable and distinct species in the collection, the whorls large and spreading, as much as 6–7 cm. across, the sterile and fertile similar, the whole of the younger part of the plant enveloped in a dense cloud of mucus. Mr. Blow remarked of one specimen that it weighed some two to three ounces when fresh. It is the only species from Madagascar having the upper cell of the dactyl allantoid instead of conical, a distinction which seems to afford an important sectional character. In a very few instances, evidently abnormal, a solitary conical end-cell has been observed.

Among those species having an allantoid end-cell (Allantoteles), *N. Blowiana* agrees with *N. dualis* Nordst. in the dactyls of both sterile and fertile branchlets being uniformly 2-celled, but, apart from the unlikeness in size and habit, differs from that species in being monœcious, the fertile branchlets being more repeatedly forked and not forming capitula, in the size of the oospore, &c. I have much pleasure in dedicating this species to my much-esteemed friend, whose indefatigable energy in collecting Charophyta, in many parts of the world, has done so much to further our knowledge of the group.

CHARA L. (emend. Agardh et alii).

1. C. **Benthamii** Braun, in Monatsb. Akad. Wiss. Berl. for 1867, p. 799 (1868); Braun & Nordst. Fragmente, pp. 18 & 117 (1882).

Near Majunga, Feb. 9 (3); Ambila, Feb. 10 (8).

In dealing with the Indian Charophyta (Journ. Linn. Soc. xlvi, p. 373, 1924), I treated *C. Benthamii* as a form or variety of *C. gymnopitys*, on account of the great variability of the latter in the relative number of branchlets and stipulodes. I find, however, that in certain plants, which may be separated as *C. Benthamii*, the number of stipulodes agrees pretty closely with that of the branchlets, and that the number of bract-cells (at the fertile nodes) seems fairly constant, and that they are usually short and stout, whereas in *C. gymnopitys* (sens. strict.) the number is variable, and they are usually longer and more slender. The Madagascar specimens are readily separable into the two groups. Dr. Nordstedt, whose opinion must carry great weight, was uncertain as to referring some plants to the one or other species. I follow the International Rules in writing the name "*Benthamii*," instead of "*Benthami*."

2. C. **gymnopitys** Braun, in Linnæa, xxv, 1852, p. 708.

Near Majunga, Feb. 9 (2); Tamatave, Feb. 16 (7); Apr. 2 (105); Ambila, Feb. 18 (12); Moramanga, Feb. 21 (19); Tananarive, Feb. 25 (24); Nemehana, Feb. 29 (38); region of Lac Itasy, Mar. 13 (66); near Andevorante, Mar. 29–30 (93); between Andevorante and Ambila (by land), Apr. 1 (100); Ankarefo, near Tamatave, Apr. 2 (109).

The eleven plants which I refer to this species exhibit a wide range of variation, differing considerably in habit, in the number of branchlets, the number, length, and diameter of the stipulodes and bract-cells, and in the size and shape of the spine-cells. The cortex is usually regularly diplostichous and pronouncedly tylacanthous. The branchlets range from 7 to 13 in a whorl, the number of segments usually 4 to 5, occasionally 6. The stipulodes always much exceed the number of branchlets, but are not often double the number they are usually very long, slender, and cylindrical, in no. 2 attaining a length of 3100 μ with sometimes so small a diameter as 50 μ, in other cases much less than half that length and very much thicker, with every intermediate. They are strongly acuminate. In nos. 93 and 100, and in one specimen of no. 12, they are reduced to minute cuspidate processes, sometimes not exceeding 125 μ, though in some whorls on the same stem they are quite long. The spine-cells are usually extremely short (sometimes not exceeding 125 μ), cuspidate, and acuminate, but in the very slender form I have found that the lowest node of each lower cortical series bears a very long (in no. 2, →2400 μ) slender spine-cell, while the remainder are minute. The bract-cells vary in number from 5 to 10, and in length from about 1200–4000 μ, in diameter from about 40–150 μ, and are all strongly acuminate. The bracteoles are much shorter than the bract-cells. Often the oogonia are immature and few oospores are present, and these only in nos. 12, 24, 66, and 129. The oospores are dark purple; in no. 24 they measure about 425–450 μ in length, in the others about 550–600 μ. The antheridia are fairly uniform in diameter (c. 300–400 μ).

3. C. HYDROPITYS Reichb. in Mössl. Handb. ed. 3, p. 1670 (1834).

Near Majunga, Feb. 9 (47).

A young, robust, incrusted form, with the stem-cortex regularly triplostichous, the spine-cells often equalling, sometimes exceeding, the diameter of the stem, the stipulodes, spine-cells, and bract-cells acuminate; the fruit is immature.

4. C. FRAGILIS Desv. in Loisel. Not. aj. Fl. Fr. p. 137 (1810).

Antsirabe, Mar. 3 (94).

A young state with immature oogonia, the stipulodes quite rudimentary, the cortex regularly triplostichous, with the primary and secondary series of equal diameter, the bract-cells and bracteoles shorter than the oogonium.

5. C. PSEUDO-BRACHYPUS Groves & Stephens, Trans. Roy. Soc. S. Afr. xiii, ii, p. 156, t. 15, figs. 8–12 (1926).

Lac Andraikiba, near Antsirabe, Mar. 4 (44); swiftly running canal on the road from Antsirabe to Lac Andranobe, Mar. 4 (44 *a*).

A less condensed tufted form than that described from South Africa.

6. C. BRACHYPUS Braun, in Hook. Journ. Bot. i, p. 298 (1849).

Anamakia near Diego Suarez, Apr. 7 (95).

A fairly typical form.

7. C. **ZEYLANICA** Willd. in Mem. Acad. Berl. for 1803, p. 86, t. 2, f. 1 (1805).

Near Majunga, Feb. 9 (4); Ambila, Feb. 18 (9); near Andevorante, Mar. 28 (85, 85 *a*, & 86); Andevorante, Mar. 29–30 (87, 87 *a*, 89); between Andevorante and Ambila (by land), Apr. 1 (88); near Tamatave, Apr. 1 (98, 99). Nos. 86 and 87 are indicated as growing in brackish water.

The above gatherings present considerable diversity in size and habit. Most of them are rather stout medium-sized plants, but in no. 99, a large straggling form, some of the branchlets measure as much as 6 cm., while in the small neat forms (85 *a*, 87) they are about 1 cm.

In Dr. Nordstedt's painstaking analysis of the named forms and varieties of this widely-distributed and polymorphic species (Fragm. Mon. Charac. pp. 24–25), the presence or absence of gametangia at the lowest branchlet-node is adopted as the distinctive character for the two primary divisions, Podophoræ and Podosteiræ. In the Madagascar specimens the node is generally sterile, but occasionally, on one or more branchlets, gametangia occur. In no case have I found a stem wholly podosteirous. The spine-cells are usually minute conical acute processes, but occasionally (*e.g.*, no. 87) some are elongated, even equalling the diameter of the stem. The stipulodes usually equal or exceed in length the lowest (ecorticate) branchlet-segment. The bract-cells are generally shorter than the oogonium, the bracteoles frequently exceeding it. The oospores, varying in length from about 625 to 800 μ, are usually ellipsoid, but sometimes almost cylindrical. On the smaller forms there are well-developed stem-bulbils. In no 86 an aftergrowth of whip-like branches with reduced whorls is produced at many of the stem-nodes.

EXPLANATION OF THE PLATES.

The scales of magnification are in all cases only approximate.

PLATE 4.

Figs. 1-7. *Nitella inæqualis* (No. 110). 1-2. Portions of plants about $\frac{7}{8}$ natural size. 3. Young fruiting whorl seen from above. 4 & 5. Apices of dactyls. 6. Apex of oogonium, with coronula. 7. Oospore.

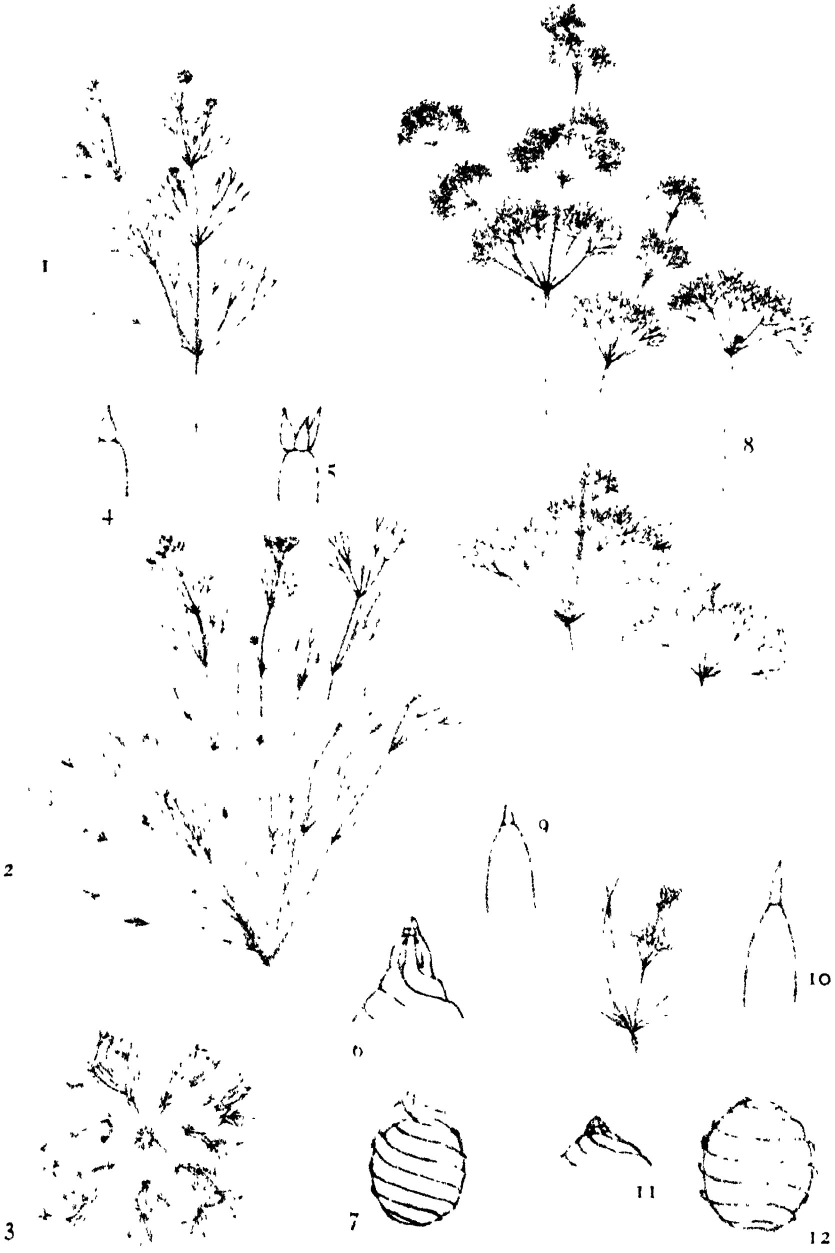
Figs. 8-12. *N. graciliformis* (No. 73). 8. Portion of plant, about $\frac{7}{8}$ natural size. 9 & 10. Apices of dactyls. 11. Apex of oogonium, with coronula. 12. Oospore.

Fig. 3: × c. 7. Figs. 4-7 and 9-12: × c. 60.

PLATE 5.

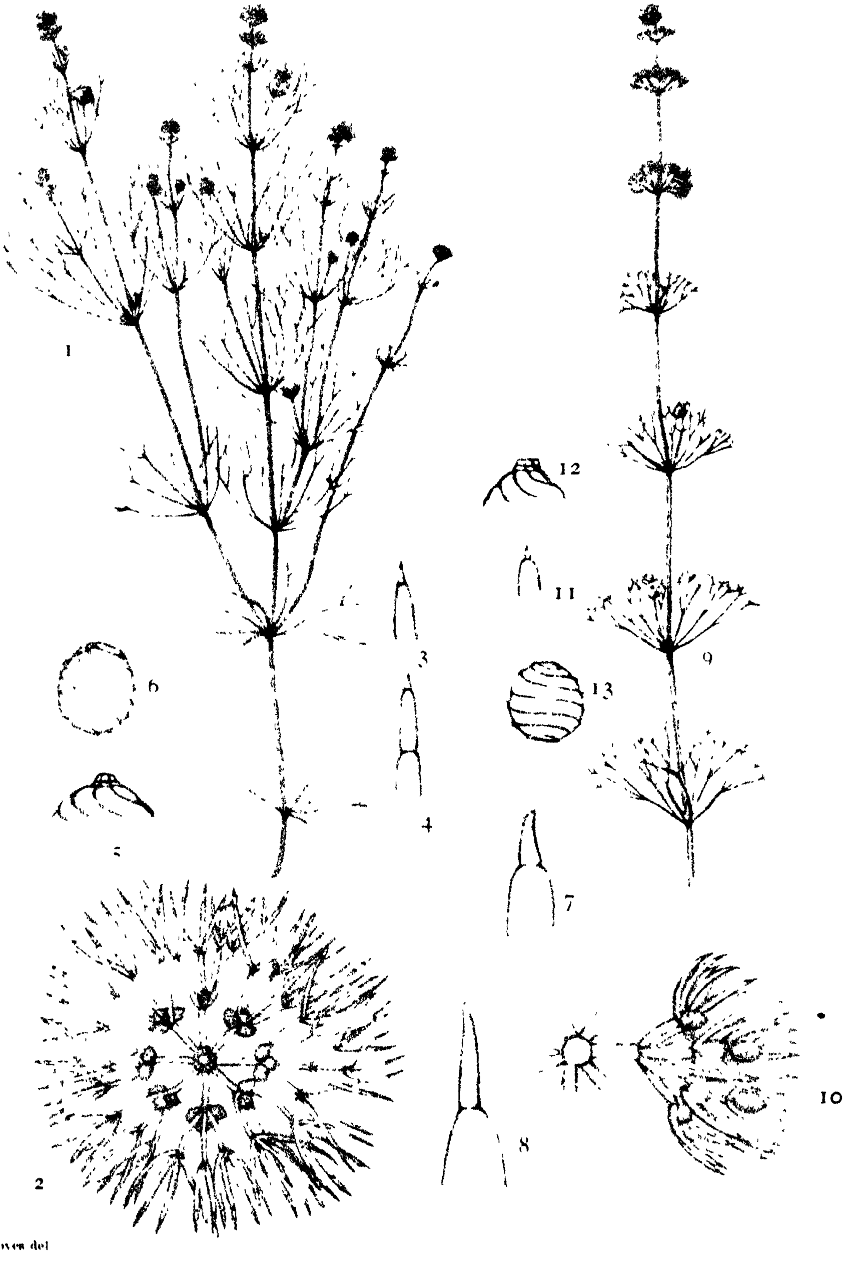
Figs. 1-6. *Nitella sphærocephala* (No. 52). 1. Portion of plant, about $\frac{7}{8}$ natural size. 2. Fruiting whorl seen from above. 3 and 4. Apices of dactyls. 5. Apex of oogonium, with coronula. 6. Oospore.

Figs. 7 & 8. *N. mucronata* var. *mobilis*. Apices of dactyls.



M. Groves del.

1—7 NITELLA INAEQUALIS sp. nov. 8—12 N. GRACILIFORMIS sp. nov.

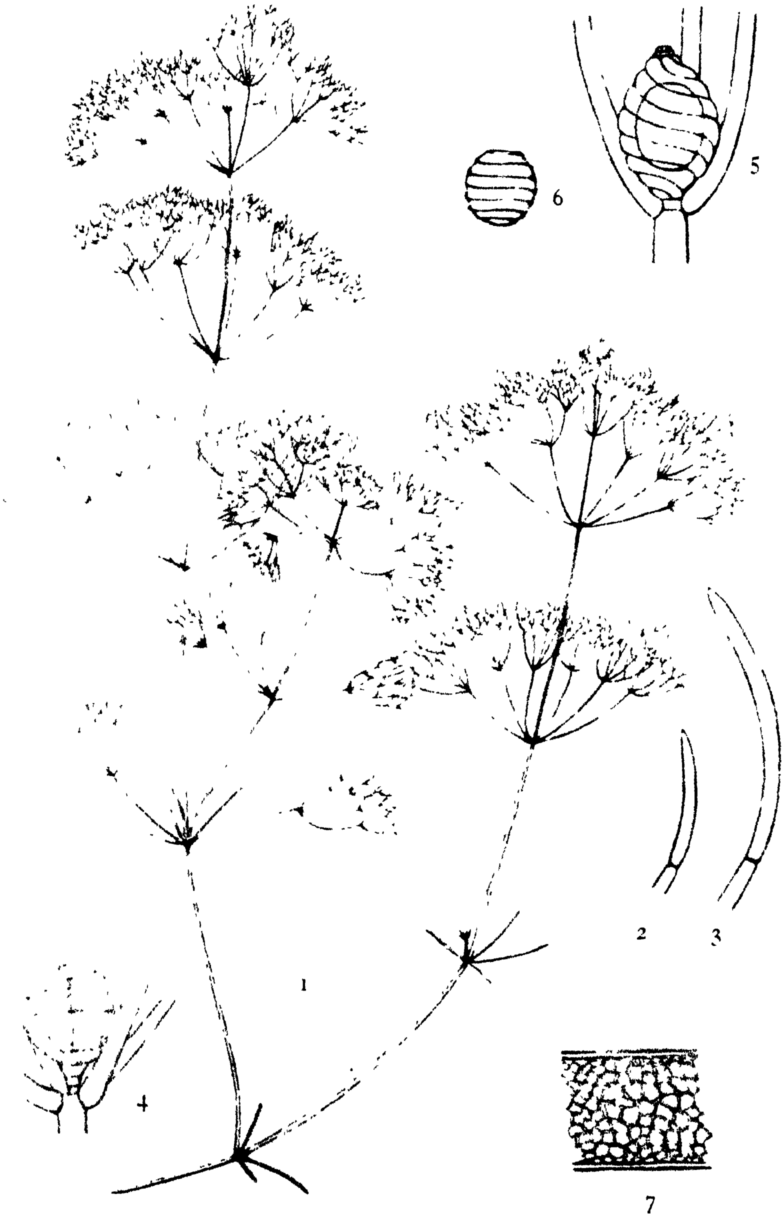


M. Groves del

1—6 NITELLA SPHAEROCEPHALA *sp. nov.*

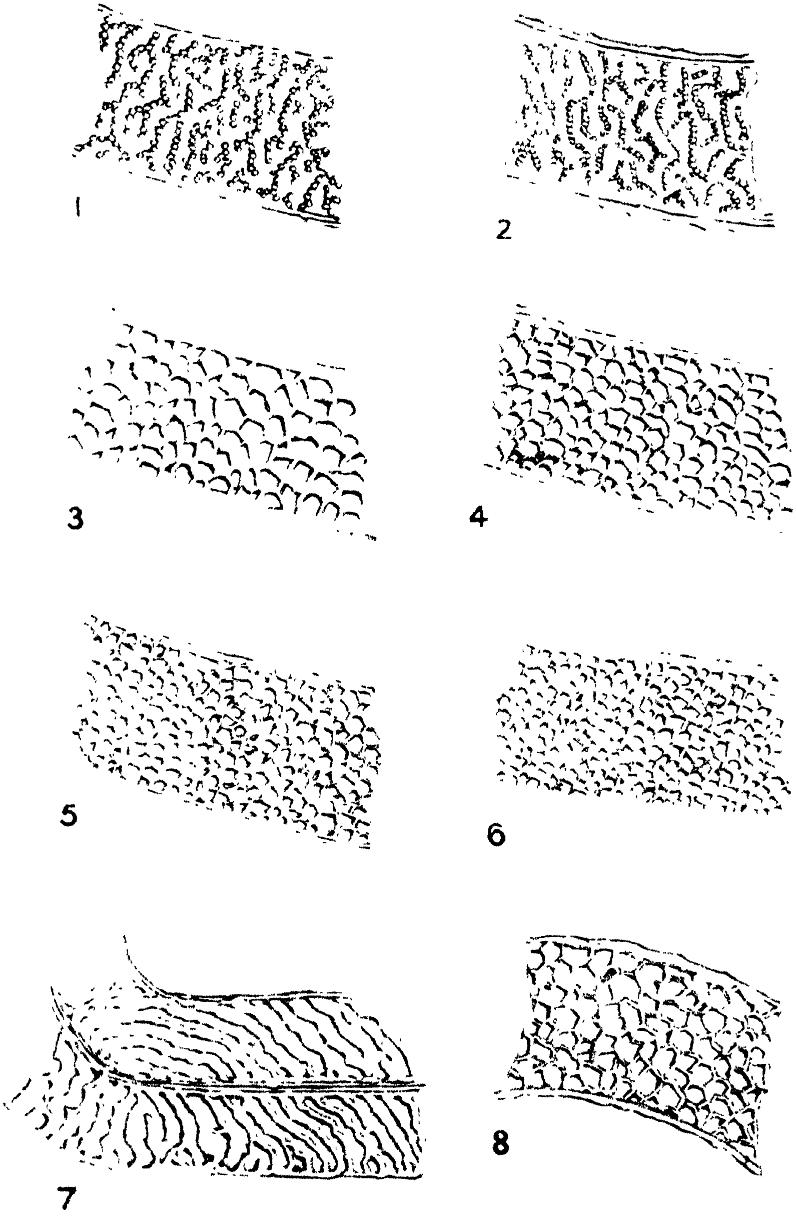
7—8 N MUCRONATA *var.* miq. MOBILIS nov.

9—13 N. VERMICULATA sp. nov.



M. Groves del

NITELLA BLOWIANA sp. nov.



G. R. Bullock-Webster del.

OOSPORE MEMBRANES.

1, 2 NITELLA VERMICULATA 3 N. SPHAEROCEPHALA. 4 N. GRACILIFORMIS.
5 N. MUCRONATA *var* MOBILIS. 6 N INAEQUALIS.
7 N. sp. 8 N. TENUISSIMA *var* CALLISTA

Figs. 9–13. *N. vermiculata* (No. 11). 9. Portion of plant, about $\frac{7}{8}$ natural size. 10. Portion of fruiting whorl. 11. Apex of dactyl. 12. Apex of oogonium, with coronula. 13. Oospore.

Figs. 2 and 10: × c. 9. Figs. 3, 4, 6, 11, and 13: × c. 35.
Figs. 5, 7, 8, and 12: × c. 60.

Plate 6.

Fig. 1. *Nitella Blowiana* (No. 36). Portion of plant, about $\frac{7}{8}$ natural size. 2 and 3. Apices of dactyls. 4. Branchlet-node bearing antheridium. 5. Branchlet node bearing oogonium. 6. Oospore. 7. Oospore-membrane.

Figs. 2–6: × c. 40. Fig. 7: × c. 350.

Plate 7.

Oospore-membranes.

Fig. 1. *Nitella vermiculata* (No. 11). 2. Ditto (No. 96). 3. *N. sphærocephala* (No. 20). 4. *N. graciliformis* (No. 73). 5. *N. mucronata* var. *mobilis* (No. 31). 6. *N. inæqualis* (No. 110). 7. *N.* sp., see p. 129 (No. 102). 8. *N. tenuissima* var. *callista* (No. 22).

Figs. 1–6: × c. 450. Fig. 7: × c. 265. Fig. 8: × c. 700.

A Cinnamon from the Bournemouth Eocene.

By HELENA BANDULSKA, A.R.C.S., M.Sc., Ph.D., F.L.S.

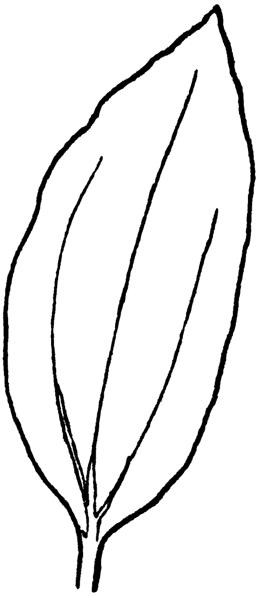
(PLATE 8, and 7 Text-figures.)

[Read 3rd May, 1928.]

INTRODUCTION.

Very few dicotyledonous leaves have been described from English strata, and still fewer have been investigated anatomically. The presence of a fossil Cinnamon in the Bournemouth Eocene beds, recognisable from both external form and cuticular structure, is therefore noteworthy.

TEXT-FIG. 1.



TEXT-FIG. 2.

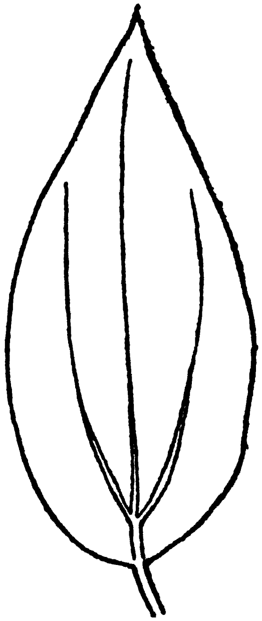


Fig. 1.—*Cinnamomum obtusifolium* Nees.
Fig. 2.—*Cinnamomum pauciflorum* Nees.

Two species of *Cinnamomum*, *C. lanceolatum* and *C. Scheuchzeri*, have been recorded by Reid and Chandler* (1926) from the Bembridge beds ; cuticles were present in both, but the state of preservation made it impossible to examine the stomata in detail. The Bournemouth leaf-cuticle, however, completely lacks the hair-bases present in both the Bembridge species, and also differs markedly from both in shape.

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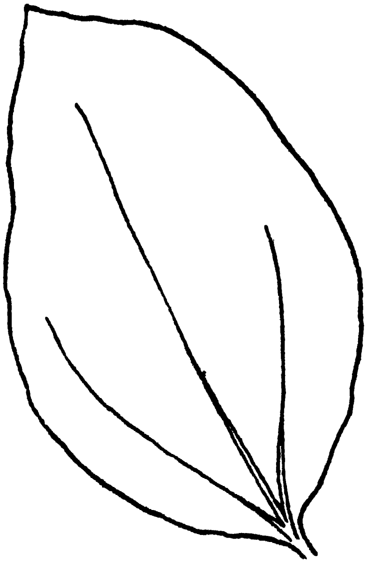
* Reid, E. M., and Chandler, M. E. J., 1926. The Bembridge Flora. B.M. Cat. Cainozoic Plants, i.

There are fifty-four living species of *Cinnamomum*, belonging to tropical and eastern Asia and Australia. Their leaves vary in shape from elliptical to ovate, the base being frequently almost as acute as the apex (*C. Camphora*, Pl. 8. fig. 1) with the widest part of the leaf near the middle; the leaves may, more rarely, be ovate, but this distinction of form is not specific (*C. obtusifolium* Nees and *C. pauciflorum* Nees, text-figs. 1, 2). They all exhibit strongly marked basal lateral veins, which are nearly or quite paired, and which may arise from the extreme base or a little way above it. The length of the leaves is generally not quite three times their width. Schimper* states that fossil Cinnamon leaves are easily distinguished from other Lauraceæ by their coriaceous entire trinerved leaves, in which the basal lateral veins pass arc-wise towards the apex, but do not reach it. Their characteristic venation and leaf-shape are not, however, diagnostic characters of *Cinnamomum* alone, for they are also exhibited by *Litsea* and *Lindera*, which belong to the same family, by *Strychnos* (text-fig. 3) a widely removed genus belonging to the Loganiaceæ, and by certain species of *Viburnum*—e. g., *V. Davidii* and *V. cinnamomifolium* as has been pointed out by Prof. Seward †. Moreover, leaves somewhat similar in form and

TEXT-FIG. 3.



Strychnos lucida Wall.

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* Schimper, W. P., 1870-72, Traité de Paléontologie Végétale, ii.

† Seward, A. C., 1924, 'Notes sur la Flore Crétacique du Groenland,' Soc. Géol. Belgique, Livre Jubilaire, i, 1, p. 254; Seward, A. C., 1926, "The Cretaceous Plant-bearing Rocks of Western Greenland," Phil. Trans. Roy. Soc. London, ser. B, ccxv, p. 128.

venation occur in the Melastomaceæ and other families. The value of cuticular studies in investigating such similar forms is at once apparent: thus the cuticle of the Bournemouth leaf here described was found to be quite unlike that of *Strychnos* or of either of the species of *Viburnum*.

Many fossil *Cinnamomum* leaves have been described from European and North American beds, but, except in the two species from Bembridge, the cuticle has not hitherto been investigated. Berry * says: "The known fossil species are more numerous than the recent species and their range during Upper Cretaceous and Tertiary times, like that of many other plant groups, is surprisingly extensive."

As the leaf here described does not exactly agree, so far as I know, with any of the previously described fossils, and as its distinctive characters are founded largely on cuticular structure, it seems best to give it a new name, and I have pleasure in naming it *Cinnamomum Wonnacotti*, after the finder, Mr. F. M. Wonnacott, who handed it to me for investigation.

CUTICULAR STRUCTURE OF RECENT SPECIES OF *CINNAMOMUM*.

CINNAMOMUM CAMPHORA Nees & Eberm.

Lower Epidermis (Pl. 8. figs. 2, 3).—Each stoma is composed of depressed guard-cells. The poral rim bears scaly ridges, and is bordered by practically symmetrical pale-coloured accessory cells, whose only indication of slight asymmetry is a tendency here and there for one to be triangular and the other to show a smoother rounded outline, but most of these pairs of accessory cells show similar rounded convex outer walls. The slightly thickened poral rim is continued to the poles as one or two delicate strands forming an extension of the long axis of the guard-cells and their scales.

The stomata are surrounded by a very variable number of straight-walled epidermal cells, and these may or may not show radiate grouping. As many as eight, or as few as three, cells may girdle the stoma. These cells show great variation in shape, size, and arrangement (text-fig. 4). They stain a little more readily than the accessory cells, but far less deeply than the scales, and therefore are very marked features of the epidermis. Venules form a rectangular meshwork over the surface. The average widths and lengths respectively of a stomatal complex are ·026 mm. and ·025 mm., and of a pair of scales ·0095 mm. and ·014 mm.

Vertical Section (text-fig. 5).—This shows lower epidermal cells which are very variable in size and bead-like in outline. The guard-cells are depressed and minute and over-arched by subsidiary cells which bear cuticular ridges. There is but little spongy parenchyma and only one row of palisade-cells. Large glandular cavities occur in the mesophyll.

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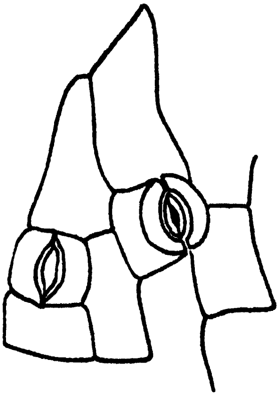
* Berry, E. W., 1924, "The Middle and Upper Eocene Floras of South-eastern North America," U.S. Geol. Surv. Prof. Paper 92, 206 pp. lxv pls.

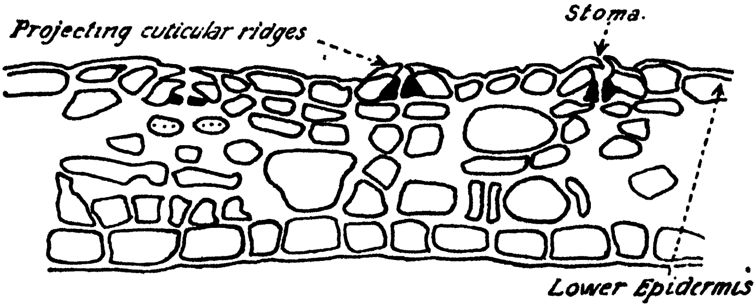
The upper epidermis consists of large empty cells with a moderately thick cuticle and sinuate vertical walls.

TEXT-FIG. 4.



Two stomata of *Cinnamomum Camphora* Nees & Eberm.

TEXT-FIG. 5.

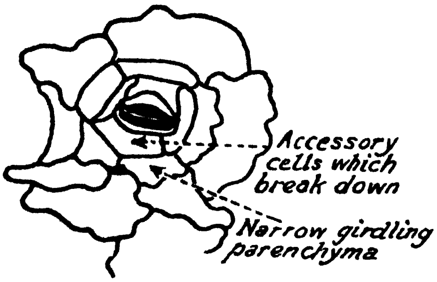


Vertical section through leaf of *Cinnamomum Camphora* Nees & Eberm.

CINNAMOMUM ZEYLANICUM Nees.

Lower Epidermis (Pl. 8. figs. 4, 5).—The epidermal cells have delicate sinuate walls, and over the surface is spread a rectangular meshwork of venules, the constituent cells of which also have sinuate walls. The stomata exhibit deeply staining paired scales partly open or entirely closed. They lie in a colourless cavity formed by the breaking down of thin-walled accessory cells, while a girdle of 4–6 narrow cells encircles each such cavity, the girdling cells being much narrower than the rest of the epidermal parenchyma, and having straight walls towards the cavity and sinuate outer walls (text-fig. 6). Colourless and sometimes apparently crystalline contents lie in the cavities. The diameters of the cavities are ·038 mm. by ·031 mm., and of the scales ·019 mm. by ·016 mm.

TEXT-FIG. 6.



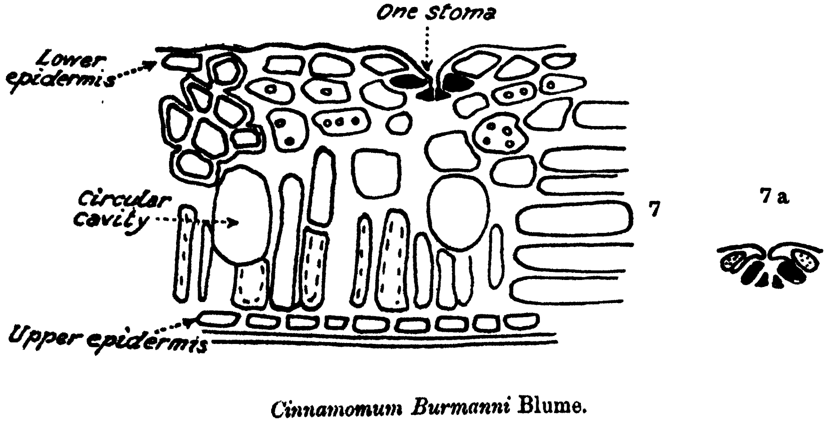
Cinnamomum zeylanicum Nees. One stoma in surface-view.

Upper Epidermis.—The sinuate-walled cells are fairly regular in size.

CINNAMOMUM BURMANNI Blume.

Lower Epidermis (Pl. 8. fig. 6).—Thin finely sinuate-walled epidermal cells enclose pairs of cells shaped like bivalve shells with a narrow orifice, or none, between them, the latter cells entirely covering and concealing the depressed guard-cells.

TEXT-FIGS. 7, 7 *a*.



Cinnamomum Burmanni Blume.

The elements, three to six in number, encircling the paired subsidiary cells vary less among themselves in size and mode of grouping than do the similar cells in *C. Camphora* and *C. zeylanicum*, and exhibit more general tendency to a radiate arrangement than is seen in *C. Camphora*.

Narrow venules composed of sinuate-walled cells are spread over the surface.

Upper Epidermis.—This consists of regular almost straight-walled parenchyma.

Vertical Section (text-figs. 7, 7 *a*).—Small depressed guard-cells are bordered and overarched by subsidiary cells, which in turn are partly covered by enclosing epidermal cells, the latter occurring at a slightly higher level; passing from below upwards, it is seen that about four rows of spongy cells are succeeded by a single layer of palisade-cells. Between the latter and the spongy cells are circular cavities, sometimes empty, sometimes containing stainable contents.

Upper Epidermis.—This exhibits a more even outline than does the lower epidermis, and its cells have thicker walls and are smaller than the lower superficial cells. The vascular bundles have much sclerenchyma.

GENERAL CHARACTERS OF THE CUTICLES OF THE GENUS *CINNAMOMUM*.

The stomata are abundant with depressed guard-cells, above which scaly ridges project. The guard-cells are surrounded by accessory cells, which are pale-coloured in *C. Camphora,* and may break down (*C. zeylanicum*). These, projecting above the guard-cells, border the pore and have a thickened poral rim, from which two thickened strands may pass to their poles.

The whole accessory cell may project in the form of a scale (*C. Burmanni*). Straight (*C. Camphora*) or sinuate-walled (*C. zeylanicum*) epidermal cells surround each stomatal complex and often, but not universally, show radiate grouping. There is variation in their size and shape, one frequently projecting in a tongue-like way far beyond the other. This is most marked in *C. Camphora.* While radiate grouping is characteristic of *C. zeylanicum*, it is not always seen in *C. Camphora.* In *C. zeylanicum* the radiately-grouped cells are narrower than the adjacent epidermal cells, but one may be sporadically larger than the rest of the group.

There is much parallelism of stomatal development between the genera *Lindera* and *Cinnamomum.*

Thus, *L. megaphylla* can be compared with *C. zeylanicum,* both having narrow girdling parenchyma surrounding each stomatal complex, but other differences make the cuticles distinctive (by papillate epidermal cells in *L. megaphylla* etc.), while the claw-like projecting accessory cells seen in *C. Burmanni* are comparable with those of *L. strychnifolia,* though again on other grounds the cuticles are not likely to be confused, for *L. strychnifolia* is extremely hairy. *C. Camphora,* however, resembles some of the *Lindera* species very closely, and is in many respects like *L. rubronervia.* It differs in the far greater irregularity of the cells surrounding each stomatal complex, firstly as regards their individual variation in size, and secondly their general grouping, which may or may not be radiate. Moreover, the *Lindera* cuticle exhibits much more general uniformity, and the nodular polar terminations of the accessory cells are more strongly marked.

The upper epidermis in all the species of *Cinnamomum* examined consists of regular thick-walled parenchyma, the cells of which show either straight or sinuate outlines.

While *C. Camphora* is practically hairless on both surfaces, *L. rubronervia* bears numerous hair-bases on the wider venules.

The genus is, moreover, distinguished from *Lindera* by the greater toughness of the cuticle. *Litsea*, *Lindera*, and *Cinnamomum* form a series in which the cuticle of *Litsea* is the most delicate. There is greater uniformity of size of the stomata in *Cinnamomum* than in *Lindera*, and, on the whole, the scales on the poral rim of *Cinnamomum* are wider and better defined; the average number of cells surrounding each stomatal complex is larger in *Cinnamomum* than in *Lindera*. Where the epidermal parenchyma shows differentiation into narrow girdling cells round the stomata and wider cells forming the general surface of the epidermis the number of girdling cells in *Lindera*—e.g., *L. megaphylla* and *L. Oldhami* (Bandulska, 1926)—is much greater than in *Cinnamomum*—e. g., *C. zeylanicum* (Pl. **8.** figs. 4, 5, and text-fig. 6).

FOSSIL SPECIES.

Cinnamomum Wonnacotti sp. n. (B.M.G.D. V. 20439).

Occurrence—Bournemouth. Beds Eocene.

Locality—Durley Chine, Bournemouth.

External Characters (Pl. **8.** fig. 7).—Leaf simple, ovate, acute, entire. The well-marked midrib bears basally two paired secondaries which pass upwards, almost parallel, to the margin. The angle made by both secondaries with the midrib varies between 15° and 20°. Higher up the leaf two additional secondary veins arise, alternating with each other on the two sides of the midrib, with which they make wider angles than do those at the base of the leaf. Length of blade 6 cm., width 2·9 cm.

Lower Epidermis (Pl. **8.** fig. 8).—The stomata are restricted to the lower surface. The guard-cells are depressed and bounded by a pair of slightly unequal accessory cells which project above them. The outer walls of the accessory cells are usually parallel to the long axis of the pore, but here and there they form a truncated triangle, the base of which rests on the thickened poral rim, whose polar extremities are bluntly beaked, stringed, or nodulose. These poral cells may be wide or narrow, and may show duplication. The width across the pair is often greater than the length. They scarcely take stain, and so are distinguished from the rest of the parenchyma. The average length of the poral axis is ·022 mm. The average width of the stomatal complex across the pore is ·027 mm. From four to seven epidermal cells (with six or seven as common numbers) enclose each stomatal complex. The encircling cells by no means always show radial arrangement, and one of the group is frequently much smaller, or sometimes much larger, than the rest. The epidermal cells have thick straight or slightly undulating walls, and vary much in size and shape.

A very few groups of round or triangular epidermal openings with thick rims irregular in size are to be seen here and there. They are possibly water-pores.

Upper Epidermis.—This is entirely composed of straight-walled parenchyma, with very numerous groups of epidermal openings, irregular in size and shape, almost as numerous as the stomata on the lower epidermis.

GENERAL CONCLUSIONS.

The leaf described closely resembles, both in external form and in the structure of the cuticle, the recent *Cinnamomum Camphora*, from which it differs in the presence of water-pores, very abundant in the upper epidermis and scarce in the lower, whereas in the recent species water-pores are absent from both upper and lower epidermis. In the fossil the average length of the stomatal complex is slightly greater than in *C. Camphora*, and in *C. Wonnacotti* the epidermal parenchyma surrounding each stoma shows, on the whole, somewhat less variability in the size and shape of the individual cells.

The cuticle of *C. Wonnacotti* bears also a general resemblance to that of a *Lindera*, showing much likeness to the cuticles of the fossils named *L. cinnamomifolia* and *L. cinnamomifolia* var. *porifera* (Bandulska, 1926), but the form of these leaves differs entirely from that of *C. Wonnacotti*. The cuticles, too, are more delicate and have more stomata per unit of area, and far fewer water-pores, while the parenchyma enclosing their stomata consists of fewer and more regular cells.

It has been pointed out in a previous paper (Bandulska) * that the stomata of the Lauraceæ exhibit a distinct family resemblance. In this large and difficult family, where the generic characters of leaf and flower are based on extremely detailed differences, great generic differentiation of the cuticular anatomy is hardly to be expected, and one genus grades into another. The cuticular structure of the species here described bears this out.

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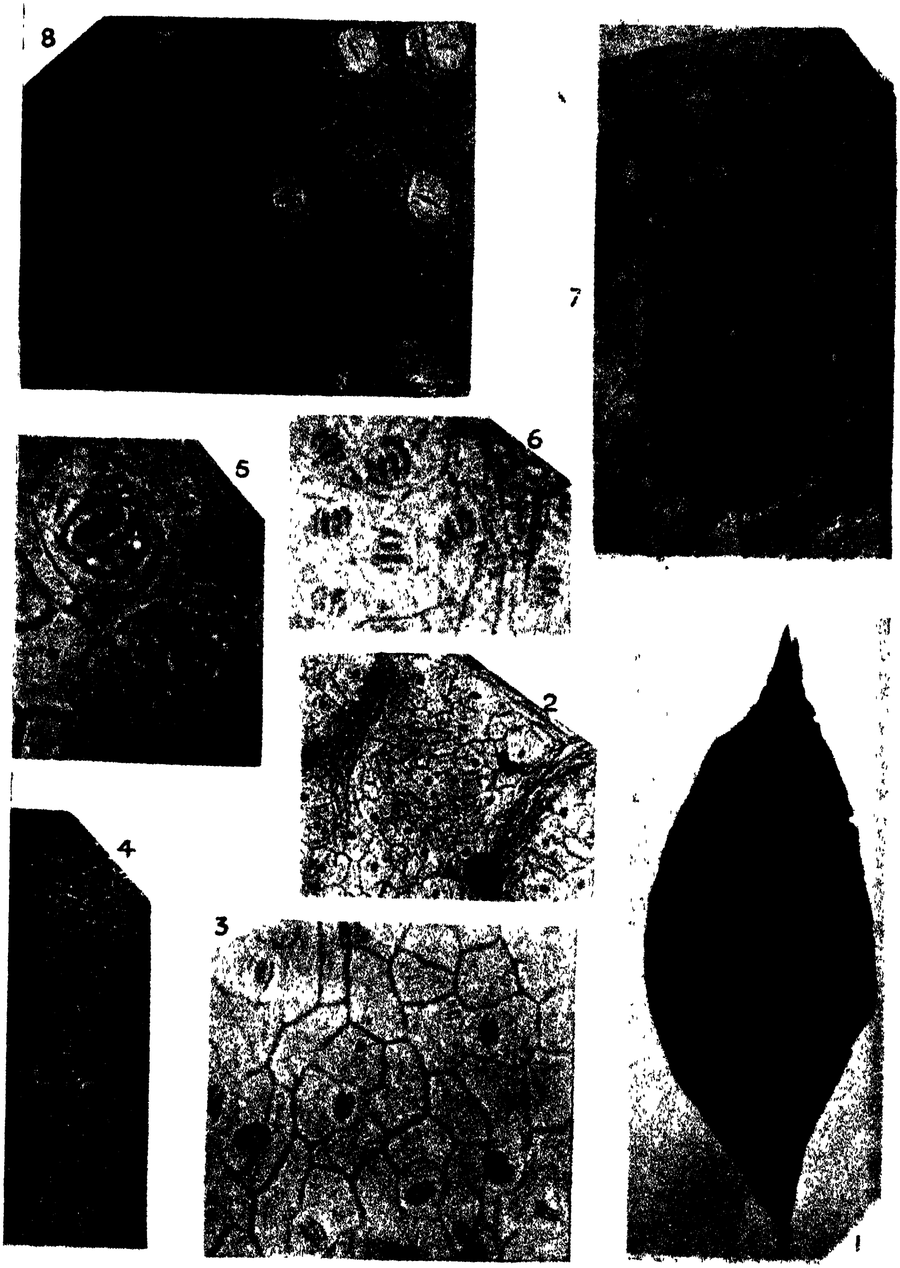
* Bandulska, H., 1926, "On the Cuticles of some Fossil and Recent Lauraceæ," Journ. Linn. Soc., Bot. xlvii, pp. 416–20, pls. 12–14



A CINNAMOMUM FROM THE BOURNEMOUTH EOCENE.

Cinnamomum has a less distinctive cuticle than had been previously appreciated ; nevertheless, when both form and cuticle are carefully investigated, the generic distinction of the leaf is capable of recognition. The cuticle is entirely different from those of *Strychnos* and *Viburnum*, that of the last genus being also of a much simpler type.

I have to thank Dr. F. A. Bather, of the Geological Department of the British Museum, and Dr. A. B. Rendle, of the Botanical Department, for allowing me the use of these departments. The photographs in the paper are the work of Mr. F. W. Edwards, Mr. E. H. Ellis, and Mr. H. G. Herring, and to these I offer my thanks.

I have again to acknowledge very gratefully a grant from the Royal Society in aid of the preparation of this paper.

EXPLANATION OF PLATE 8.

CINNAMOMUM CAMPHORA Nees.

Fig. 1. External characters.
2. Under epidermis. × 135.
3. Under epidermis. × 700.

CINNAMOMUM ZEYLANICUM Nees.

Fig. 4. Under epidermis. × 135.
5. Under epidermis. × 540.

CINNAMOMUM BURMANNI Blume.

Fig. 6. Under epidermis. × 700.

CINNAMOMUM WONNACOTTI sp. n.

Fig. 7. External characters. B.M.G.D. No. V. 20439.
8. Under epidermis. × 700.

The Botanical Collection made by Captain F. Kingdon Ward in the Eastern Himalaya and Tibet in 1924–25. By C. V. B. MARQUAND, M.A.

[Read 19th January, 1928.]

INTRODUCTION.

Before enumerating the present valuable collection it is well to recall the previous botanical work on the area which it covers. The most important work on the botany of this country as a whole is "The Flora of Tibet or High Asia" by Hemsley and Pearson which was published in the 'Journal of the Linnean Society' in 1902.

That work includes a detailed account of the collections made up to that time and an analysis of the Flora as then known with the distribution of the 283 species enumerated. Most of these earlier collections were made in western Tibet and nothing was then known of the rich flora of the south-eastern part of the country adjoining Yunnan. Hence the surprisingly small number of species recorded.

In the past quarter of a century several collections have been made in southern Tibet and many more on the Chinese borders on the east. Among the former are those of Major (now Sir Francis) Younghusband on the Tibet Frontier Commission in 1903 and Capt. Walton in the following year. Several species which they collected for the first time on the mountains near Lhasa were found again by Capt. Kingdon Ward in 1924. Col. L. A. Waddell also made a valuable collection there in the year 1904. Major H. M. Stewart collected at Gyantse in 1907 and in subsequent years the Lepcha collectors, Ribu and Rhomoo, employed by the Calcutta Botanical Garden, collected in Tibet as well as in Sikkim. Finally, small collections were made by members of the three Mount Everest Expeditions in the years 1921, 1922 and 1924 respectively. Capt. Kingdon Ward accompanied the last of these expeditions on the first part of the journey from Darjeeling. Afterwards his route lay from Gyantse eastwards past the south side of the Yamdrok Tso to Tsetang on the Tsang-po, the journey beyond the lake being over unexplored ground. From Tsetang continuing in an easterly direction the Lung La, a pass of over 16,000 feet, on the supposed continuation of the Trans-Himalayan range, was traversed on the way to Gyatsa. There the Tsang-po was again met with and followed down past Nang Dzong to Tsela Dzong where species of *Caragana* are plentiful and many interesting plants were collected. He then crossed the Temo La to Tumbatse and entered the region, in the neighbourhood of lat. 29° 40′ N., long. 95° E., where the most important part of the collection was made. Immediately east of Tumbatse are the Tra La, Tang La and Nyima La in order from north to south within a few miles; and still further east on the far side of the Tsang-po (which here takes a sinuous course between Pe in the south and Gyala in the north) are the Nam La and Doshong La. These latter high passes traverse the eastern extremity of the Himalaya, the Nam La passing over a southern spur of the lofty Namcha Barwa at an altitude of some 17,500 feet. Specimens were collected on all of these passes as well as from the gorge of the river itself. It is evident that this district is distinctly rich in higher alpines.

During the month of August an expedition was made along the Rong Chu from Tumbatse northwards to Tong kyuk Dzong and thence in a westerly direction along the Tsang-po Salween divide up a tributary of the Po-Tsang-po, rising some 6000 feet from Tong kyuk Dzong to the Nambu La at 15,000 feet altitude. An extensive collection was made in the neighbourhood of Trasum Lake beyond this pass in lat. 30° N., long. 94° E. Continuing north-west past Drukla Gomba and Pungka, the Trasum Kye La was ascended and a descent made to Atsa Tso where further collections were made and the Benda La, a pass of over 18,000 feet, and the most northerly point on the expedition, was visited. On the way back to Tumbatse the watershed was crossed by the Tro La which is further west than the Trasum Kye La and only slightly exceeded by it in altitude, and a more fertile region entered on the descent to Gyamda, whence the river was followed to its confluence with the Tsang-po at Tsela Dzong. Between this and Tumbatse the Temo La had to be crossed and this last pass, like the Nam La on the other side of the river, yielded a number of plants, several of which were new.

The steep forested gorge of the Tsang-po was followed down to Paji some miles below Gompo Ne where the river is joined by the Po-Tsang-po at an altitude of 5247 feet. Here a number of species belonging to subtropical genera of Acanthaceæ etc. were found. Specimens of Bamboos which are probably new, but unfortunately in a barren state, were also collected here [*]. On the return journey in the winter Capt. Kingdon Ward travelled over the same route as he had in August as far as Pungkar, but finding it impossible to cross the Trasum Kye La so late in the season returned to Shoga Dzong and followed the river to Gyanda and after making a short excursion northwards took the Lhasa road to Tsumara over the Kongbo Pa La

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[*] Further geographical details with some excellent photographs and a most useful map constructed from Capt. Ward's plane table and compass traverse will be found in his paper in the 'Geographical Journal,' lxvii, No. 2, pp. 97–123 (February 1926).

(18,022 feet altitude) late in January. From Tsumara the journey lay south, crossing the Tsang-po by the ferry at Tsetang and over the Trans-Himalayan range by the Yarto Tra La (16,700 feet altitude) and by Tzona Dzong in the main Himalayan range into eastern Bhutan where plants were once more collected at a lower altitude before reaching India in February 1925.

The collection is a particularly interesting one from the phytogeographical point of view as very little was known previously of the flora of the large area around the most easterly extremity of the Himalayan range and ranges further north-west where the connecting-links between the well-known Eastern Himalayan flora and the now scarcely less well-known flora of South-west China, would be expected. This expectation has been fully justified. In general the collection may be said to contain three distinct floras:—(1) the region of high rainfall in Alpine Sikkim, (2) the true Tibetan flora and (3) the subtropical flora of the lower part of the Tsangpo Gorge and of Eastern Bhutan; the last collected on Capt. Kingdon Ward's return journey to India early in 1925.

Of these floras the second contains by far the greatest number of new species. Alpine Sikkim has been visited by many botanists since 1849 when Sir Joseph Hooker made the first extensive collections. The majority of the plants collected there were also found previously by Smith and Cave in 1910 in the Zemu and Llonakh valleys *, but many of Griffith's plants from Bhutan were collected again after nearly a century.

The true Tibetan Flora is much more xerophytic than that of either the Eastern Himalaya or Yunnan, both of which are exposed to the monsoons; but the high ranges between the great gorges in N.W. Yunnan effectively screen the western portions of Sze-chuan, so that the climate and consequently the flora of the high mountains of this province have closer affinities with those of Tibet than of Yunnan, and numerous species range right across S.E. Tibet from the northern slopes of the main Himalayan range north of Sikkim to Western Sze-chuan but are not found in Yunnan except on its extreme northern border. As would be expected the majority of the species are perennials and exhibit the same adaptations for withstanding cold and exposure as those found among the familiar Swiss Alpines. In the Tsang-po valley, where it traverses the Tibetan Plateau between 9700 feet and 10,700 feet altitude in the neighbourhood of Tsela Dzong, spinous shrubs, particularly species of *Caragana*, were abundant growing with *Salix babylonica* and *S. amygdalina* var. *nipponica* and other species. In the villages, trees were noted as being usually found pollard. On the moraines of the glaciers and on the mountains above, the herbaceous flora is by no means a poor one, extending to beyond 17,000 feet altitude.

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* **Published in the 'Records of the Botanical Survey of India,' iv, 141 260, with a map and 2 plates,**

The material available now makes it quite clear that one homogeneous flora extends across from Sikkim to Western China, and the whole of the Eastern Himalaya, South-eastern Tibet and Western Sze-chuan as well as the upper portion of Yunnan should be considered as one botanical area.

In the following enumeration the genera *Meconopsis*, *Primula* and *Rhododendron* are omitted. *Meconopsis* has been dealt with by Capt. Kingdon Ward himself in the 'Annals of Botany' (1926, pp. 535–546), *Primula* was undertaken by Professor W. W. Smith and published in the 'Notes from the Royal Botanic Garden, Edinburgh,' in the same year (pp. 69–89), while the last genus is being worked out by Mr. J. Hutchinson and will be published separately.

With these three important genera excluded, the number of species collected is 446 of which 52 species and 27 varieties are new and described here for the first time.

The genera most strongly represented apart from the three mentioned immediately above are the following:—*Anemone*, *Saxifraga*, *Gentiana* and *Pedicularis*, the last by no fewer than twenty species besides several varieties.

The author would like to express his appreciation of the assistance he has received from Mr. H. K. A. Shaw whose name appears as joint author of a great many of the new species and varieties described below.

Finally, it may be mentioned that the types of all the new species as well as a complete set of the specimens have been presented to the Herbarium of the Royal Botanic Gardens, Kew.

ENUMERATION OF THE COLLECTION.

CLEMATIS FORRESTII W. W. Sm. in Notes Roy. Bot. Gard. Edin. viii, 183.

Petals cream with purple stamens. In open situations in the lower forest, climbing large trees. Tsang-po Gorge, at Gompo Ne, 1800 m., Dec. 4, 1924. 6342.

CLEMATIS GRAVEOLENS Lindl. in Journ. Hort. Soc. i, 307.

Flowers yellow, nodding, leaves pale sea-green. In sandy soil, by the river, growing in shady situations, on the margin of woods and in thickets. Flowers turn brick-red as they age. Fruits with very long style and hairs. Tongkyuk, 2700–3000 m., Aug. 12, 1924. 6081.

CLEMATIS LOASÆFOLIA DC. Syst. i, 140.

Flowers cream, thimble-shaped; the tips of the petals recurved. In thickets, on dry rocky slopes. Trashigang Dzong, East Bhutan, 1800 m., Feb. 16, 1925. 6424, CLEMATIS MONTANA Ham. ex DC. Syst. i, 164, forma ? (immature).

Flowers either pure white, or more commonly white flushed on the outside with purplish pink which shows through. Scrambling over bushes in every thicket or sheltered slopes ; or spreading over the ground in the Tsang-po valley below Tsetang, 3000–3400 m., Apr. 26, 1924. 5634.

CLEMATIS ORIENTALIS Linn. Sp. Pl. 765, var. ACUTIFOLIA Hook. fil. & Thoms. Fl. Ind. i, 9.

Flowers more or less chocolate-red inside, yellow at the base outside, with chocolate lobes. In *Picea* forest, Nyima La, 3400–3600 m., June 22, 1924. 5823.

CLEMATIS REHDERIANA Craib in Kew Bull. 1914, 150.

Flowers pale straw-yellow. Sprawling over hedges in the village lanes of the Tsang-po valley below Pe, 2700–3000 m., July 28, 1924. 6032.

CLEMATIS UROPHYLLA Franch. in Bull. Soc. Linn. Par. i, 433.

Flowers cream. In mixed forest, Tsang-po Gorge, 2400 m., Nov. 19, 1924. 6290.

THALICTRUM ALPINUM Linn. Sp. Pl. 545.

On dry earth banks, under oak scrub on the exposed flank of the hill. Tsela Dzong, 3600–3900 m., May 30, 1924. 5720.

THALICTRUM DIFFUSIFLORUM Marquand & Shaw sp. n. ex affinitate *T. Chelidonii* DC. sed foliis multo plus decompositis, foliolis minimis, floribus paucis laxe diffusis haud pyramidato-paniculatis, præcipue differt.

Herba perennis erecta glabra, usque 2–3 m. alta. *Radices* dense fasciculatæ. *Caulis* superne parce ramosus. *Folia* 3–5-pinnata, usque 20 cm. longa, pinnis pinnulisque oppositis ; foliolis parvis, foliorum inferiorum suborbicularibus, 5–7 mm. diametro, apice 3–5-lobatis, lobis acutis vel obtusis, foliorum superiorum etiam minoribus, c. 3 mm. longis, 2 mm. latis, plus minusve rhomboideis incisis acutis subacutisve ; petiolo basi vaginante, vagina membranacea in siccitate caule fusciore ovata striata, apice libera. *Inflorescentia* paniculata laxa pauciflora diffusissima, ramis flexuosis. "*Flores* lilacini." *Pedunculus* gracilis, usque 2·5 cm. longus. *Sepala* "plerumque quinque," ampla ovato-lanceolata, c. 12 mm. longa, 6 mm. lata, apice acuto vel subacuto. *Stamina* numerosa : filamentis filiformibus vel superne levissime incrassatis; antheris linearibus, c. 2 mm. longis, apice subobtusis. *Ovarium* c. 20-carpellatum ; carpellis fusiformibus glandulosis, c. 2 mm. longis, breviter stipitatis, in stylum carpello sublongiorem attenuatis ; stigmate inconspicuo. *Fructus* non visi.

S.E. TIBET : In sheltered pastures and thickets, under trees or bushes, etc. Tumbatse, 3600 m., July 7, 1924 (*F. Kingdon Ward*). 5899.

THALICTRUM LEUCONOTUM Franch. Pl. Delav., 16.

In open damp pastures in the valley. Rong-chu (Tumbatse), 3600 m., June 15, 1924. 5788.

ANEMONE DEMISSA Hook. fil. & Thoms. Fl. Ind. i, 23.

Flowers white, stamens violet. On steep alpine turf slopes, facing south. Doshong La, 3600–3900 m., June 25, 1924. 5860.

Var. GRANDIFLORA Marquand & Shaw var. nov. a typo differt floribus sub-duplo majoribus usque 4 cm. diametro, caudice foliorum basibus maceratis dense intertextis cincto.

Flowers white, the under side of the petals purple, which tinges the white upper surface. On steep alpine turf slopes, Nyima La, S.E. TIBET. 4500–4800 m., June 21, 1924, *F. Kingdon Ward* 5816. *Forrest* 14037 from North-western Yunnan is probably a very densely pilose form of this variety and many other specimens from Western China in Herb. Kew. approach this variety.

ANEMONE OBTUSILOBA D. Don Prod. 194.

Flowers purple. In alpine pastures, growing amongst dwarf *Rhododendron*, generally on banks and slopes. Nyima La, 4200–4500 m., June 21, 1924. 5815. Nyima La, 4500–4800 m., June 21, 1924. With 5816.

Flowers white. On open pasture slopes. Nam La, 4200–4500 m., July 24, 1924. 5992.

ANEMONE RUPESTRIS Wall. ex Hook. fil. & Thoms. Fl. Ind. i, 21.

Flowers deep purple. On alpine turf slopes on the exposed flank of the Sang La, 4500–4800 m., July 8, 1924. 5911.

Var. VILLOSA Marquand & Shaw var. nov. a typo differt omnibus partibus (staminibus carpellisque exceptis) parce villosis foliis minus dissectis.

S.E. TIBET: Flowers purple. In open pastures, in the *Rhododendron* shrub belt. Nyima La, 3900–4200 m., June 22, 1924, *F. Kingdon Ward* 5821.

Var. PILOSA Marquand & Shaw var. nov. a typo differt foliis brevius petiolatis et utrinque cum petiolis caulibus bracteis et dorso sepalorum plus minusve pilosa; carpellis densissime sericeis.

S.E. TIBET: Flowers snow-white, violet on reverse. In pastures amongst dwarf *Rhododendron* on the open moorland. Temo La, 4200–4500 m., June 6, 1924, *F. Kingdon Ward* 5747.

ANEMONE TRULLIFOLIA Hook. fil. & Thoms. Fl. Ind. i, 22.

Flowers white, petals violet on the reverse. On dry open grassy banks. Tumbatse, 3600 m., July 3, 1924. 5896.

Var. SOULIEI Finet & Gagnepain Flor. As. Or. i, 74.

Flowers lemon-yellow. On open grassy banks in the forest at Temo La, 4000 m., June 8, 1924. 5761. "Also in meadows of the Rong-Chu."

ANEMONE WARDII Marquand & Shaw sp. n. ex affinitate *A. rupestris* Wall. sed habitu compactiore foliis minus compositis segmentis basi cuneatis haud rotundatis præcipue differt.

Herba perennis. *Radix* tuberosa. *Caules floriferi* usque tres, erecti vel adscendentes robustiores, inferne parce (supra involucrum densius) pubescentes pallide brunnei, usque 7 cm. longi. *Folia radicalia* c. 1·5 cm. diametro, biternatim lobata, lobis sessilibus subsessilibusve basi cuneatis, lobulis obovatis subacutis vel apiculatis, basi angustissimis. *Folia caulina* nulla. *Bracteæ* involucrales tres, 1–2·5 cm. infra florem, elliptico-oblongæ simplices vel 2–3-lobatæ, 1–1·3 cm. longæ. *Flos* solitarius terminalis saturate violaceus. *Perianthii segmenta* quinque vel sex, obovata, 7–8 mm. longa, 4–6 mm. lata, apice lato subobtuso; nervibus parallelis numerosissimis. *Stamina* c. duodecim: filamentis 2–3 mm. longis, late alatis; antheris ovoideis apiculatis. *Receptaculum* convexiusculum. *Achænia* numerosa oblique fusiformia glaberrima, parte superiore excepto stylo atro-brunnea. *Stylus* subcurvatus. *Fructus* non visi.

S.E. TIBET: On muddy meadow slopes with *Primula, Pedicularis*, dwarf *Rhododendron*, etc., all flowering in the snow. Doshong La near Pemako, 3000 m., Oct. 25, 1924, *F. Kingdon Ward* 6262.

ADONIS BREVISTYLA Franch. in Bull. Soc. bot. Fr. xxxiii, 372.

Flowers white, bluish on the reverse, stamens golden. On shrub-clad sheltered slopes by streams. Tsela Dzong, Tsangpo Valley, 3000–3400 m., May 12, 1924. 5662.

RANUNCULUS OREIONANNOS Marquand & Shaw sp. n. ex affinitate *R. tricuspidis* Maxim. sed habitu humiliore et graciliore, foliis trifoliolatis petalis semper 5 staminibus paucioribus differt.

Herba perennis minuta erecta, vix 1 cm. alta. *Folia* omnia basalia trifoliolata interdum simplicia lineari-lanceolata crassiuscula glabra; foliolis obovatis subobtusis integris vel lateralibus nonnunquam obscure bilobatis, c. 1 mm. longis, 0·7 mm. latis; petiolo graciliore 3–4 mm. longo. *Flores* terminales solitarii 5–7 mm. diametro. *Scapus* 0·5–1·0 cm. longus sparse villosus. *Sepala* tria usque quinque, elliptico-obovata, marginem versus apicemque obtusum fusca, c. 2 mm. longa, 1 mm. lata. *Petala* quinque, læte flaventia intus nitentia, elliptico-obovata, 2–3 mm. longa, 1·5–2·0 mm. lata, apice rotundata. *Stamina* quinque usque octo, petalorum dimidium longitudinem fere æquantia; filamentis robustis; antheris oblongis. *Carpella* numerosa attenuata vel rostrata, sub anthesi extrinsecus haud evidenter notata. *Fructus* non visi.

S.E. TIBET: A minute plant forming closely woven tufts on earthy slopes, on the great screes on the Nam La, 4200–4500 m., July 26, 1924, *F. Kingdon Ward*. 6007.

TROLLIUS PUMILUS Don Prodr. 195.

Flowers bright golden-yellow with orange staminodes. In open pastures on the lee side. Kongbo Peri, 3900–4200 m., May 25, 1924. 5702.

PARAQUILEGIA MICROPHYLLA Drummond & Hutchinson in Kew Bull. 1920, 156.

Flowers pale purple, with golden anthers. A few tufts seen on an earth-scree, facing south-west. Nam La, 4500 m., July 26, 1924. 6005.

DELPHINIUM GLACIALE Hook. fil. & Thoms. Fl. Ind. i, 53.

Flowers pale smoky violet, veined darker violet. Forming clumps among the boulders, at the highest level of flowering plants. Pa-sum-kye La, 4800-5100 m., Aug. 25, 1924. 6124.

DELPHINIUM GYALANUM Marquand & Shaw sp. n. ex affinitate *D. speciosi* M. Bieb. præcipue var. *ranunculifolii* (Wall.) Huth sed calcari subrecto sepalis intus glabris tota planta glabrescente vel sparse pubescente inter alia differt.

Herba erecta, usque 2–2·5 m. alta. *Caulis* glabrescens purpurascens striatus. *Folia caulina inferiora* ambitu subreniformia, 18-22 cm. diametro, fere ad medium c. 5–7-lobata lobis inciso-dentatis, utrinque glabrescentia, petiolo usque 14 cm. longo sparse pubescente. *Folia caulina suprema* palmatifida inciso-dentata breviter petiolata glabrescentia. *Inflorescentia* racemosa inferne ramosa multiflora; bracteis linearibus c. 1·5 cm. longis. *Flores* saturate cœrulei, 3·3–3·7 cm. longi, longipedicellati. *Sepala* obovato-rhomboidea obtusa extus pubescentia, 1·4–1·6 cm. longa; calcari recto vel apice leviter decurvato, c. 2 cm. longo, apice attenuato. *Petala* quatuor, anguste lanceolata; calcari attenuato curvato apicem versus tubulari, limbo c. 1 cm. longo; inferioribus spathulatis, 10–12 mm. longis, c. 2 mm. latis, limbo bifido luteo-barbato. *Stamina* c. 6 mm. longa. *Carpella* tria, juniora dense pilosa. *Fructus* non visi.

S.E. TIBET: In shady thickets on the exposed flank of the valley. Gorge of the Tsang-po, near Gyala, 2700 m., July 21, 1924, *F. Kingdon Ward* 5969.

DELPHINIUM LANKONGENSE Franch. Pl. Delav. 26.

Flowers brilliant blue. On grassy slopes and in open pastures and meadows. Atso Tso, 3900–4200 m., Aug. 26, 1924. 6146.

DELPHINIUM PYLZOWI Maxim. in Bull. Acad. Petersb. xxiii, 307.

Flowers rather large, white flushed pale bluish violet or sometimes dark uniform violet; 2 central petals velvety black, with a conspicuous tuft of bright yellow hairs in the centre, looking like the wings of an insect. In meadows and dry places. Pas-um-kye La, 4200–4500 m., Aug. 25, 1924. 6123. Noted on the following day as extending into the high alpine region at 4500–4800 m., growing in muddy streams.

DELPHINIUM WARDII Marquand & Shaw sp. n. affinis *D. viscoso* Hook. fil. & Thoms. et *D. tsarongensi* Hand.-Mzt. sed a priore floribus majoribus a posteriore calcari longiore inter alia distinguendum.

Herba perennis, caudice graciliore caules floriferos usque tres gerente. *Folia basalia* reniformia quinatim palmatifida utrinque sparse pilosa, c. 4 cm. diametro; lobis obtuse trilobulatis; petiolo pubescente 2–5 cm. longo. *Caules* pubescentes erecti, usque 15 cm. longi, efoliosi vel folio unico parvo pubescente trifido prædito. *Bracteæ* spathulatæ, 1·0–1·5 cm. longæ, 2–3 mm. latæ. *Flores* ampli violacei terminales solitarii vel bini. *Sepala* sericeo-pilosa; posticum orbiculare brevissime et late apiculatum, c. 2 cm. diametro, calcari leviter decurvato, 1·7–2·0 cm. longo, 2–4 cm. lato, obtuso; lateralia latissime ovata obtuse acuminata, c. 2 cm. longa, 1·5–1·7 cm. lata, duo superiora duobus inferioribus aliquanto teneriora. *Petala* quatuor: duo superiora linearia, c. 3·3 cm. longa, 3 mm. lata, basi attenuata ad extremitatem calcaris sepalini attingente, apice leviter angustata, inæqualiter bifida; duo inferiora c. 1·6 cm. longa, unguiculata, ungue lineari c. 1 mm. lato cuspide parva laterali prope basin prædito, lamina c. 4 mm. lata ungui æquilonga, fere usque ad basin inæqualiter bifida, barbata. *Stamina* c. triginta: filamentis 5–7 mm. longis, basin versus complanatis; antheris oblongis fuscis. *Carpella* tria, ad suturam pilosa ceterum glaberrima, 4–5 mm. longa, ovato-lanceolata. *Styli* 2–3 mm. longi.

S.E. TIBET: On alpine turf slopes, amongst dwarf *Rhododendron* etc. Tang La, 4200 m., Sept. 20, 1924, *F. Kingdon Ward* 6193.

This species occupies a somewhat intermediate position between *D. viscosum* and *D. tsarongense*, resembling the former in the long spur and the latter in the large flowers, while the leaves are intermediate between the two. The Tang La, where it is found growing, is about halfway between Alpine Sikkim, where *D. viscosum* occurs, and the Doker La in Tsarong on the borders of China, where *D. tsarongense* was collected by Dr. Handel-Mazzetti.

ACONITUM GYMNANDRUM Maxim. in Bull. Acad. Pétersb. xxiii, 308.

Flowers violet. On stony slopes below the cliffs, and in pastures. Atsa, 4200 m., Aug. 28, 1924. 6168.

ACONITUM NAVICULARE Stapf in Ann. Roy. Bot. Gard. Calc. x, 2. 154.

Flowers violet. Dwarf herb growing on alpine turf slopes. Temo La, 4200–4500 m., Sept. 14, 1924. 6185.

ACONITUM SOONGARICUM Stapf in Ann. Roy. Bot. Gard. Calc. x, 2. 141, var. LASIOCARPUM Marquand & Shaw var. nov. a typo differt foliis latius sectis carpellis nectariorumque unguibus pubescentibus.

Flowers colourless or faintly tinged with violet. Plant of 2–3 m. growing in clumps in open meadows.

S.E. TIBET: Nambu La, 3000–3600 m., Aug. 13, 1924, *F. Kingdon Ward* 6085.

ACONITUM TANGENSE Marquand & Shaw sp. n. affinis *A. tatsienensi* Fin. & Gagnep. et *A. Franchetii* Fin. & Gagnep. sed foliis palmatim bipinnatifidis sepalis intus solum pubescentibus casse angustiore differt.

Herba perennis erecta glabra c. 40 cm. alta. *Folia* omnia longe petiolata; petiolo usque 11 cm. longo; lamina palmatifida segmentis sex vel septem bipinnatifidis usque 6 cm. longis, lobulis ultimis mucronatis. *Inflorescentia* primo racemosa, dein paniculata. *Flores* violacei, pauciores. *Pedunculus* longiusculus flexuosus. *Bracteolæ* singulæ pinnatifidæ usque 2 cm. longæ, c. 1 cm. infra florem. *Sepala* extra glabra, intus sparse pubescentia, margine interdum ciliato: anteriora elliptica, c. 1·0–1·3 cm. longa, 4–5 mm. lata, subobtusa; lateralia suborbicularia, 1·0–1·5 cm. diametro; cassis semi-elliptica usque 2·5 cm. longa, 5–8 mm. lata, basi attenuata, apice acuminato subresimo, margine inferiore concaviusculo. *Petala* duo, glabra; ungue gracili limbum ineunte abrupte geniculato; limbo oblongo obtuso emarginato; calcari circinato incrassato. *Stamina* glabra; filamentis subulatis alatis interdum apicem versus cordato-truncatis. *Carpella* quinque fusiformia glabra. *Fructus* non visi.

S.E. TIBET: On the open moorland amongst dwarf *Rhododendron*. Tang La, 4200–4500 m., July 17, 1924, *F. Kingdon Ward* 5945.

ACONITUM VOLUBILE Pall. ex Koelle Spicil. 21, var. LATISECTUM Regel in Radde Reis. Sud-Ostsib. i, 92.

A twiner with glossy violet flowers. In thickets in the sub-alpine region. Temo La, 3690–3900 m., Sept. 15, 1924. 6189.

PÆONIA DELAVAYI Franch. in Bull. Soc. bot. Fr. xxxiii, 382, var. LUTEA (Delav. ex Franch.) Finet & Gagnepain Flor. As. Or. i, 221 (= *P. lutea* Delavay).

Flowers bright golden-yellow, slightly scented, though the scent is not very pleasant. On the open hillside where the ground is slightly damper than usual. Tsela Dzong, 2700–3000 m., May 22, 1924. 5691.

MAGNOLIA ROSTRATA W. W. Sm. in Notes Roy. Bot. Gard. Edin. xii, 213.

Tree of 12–15 m. with leaves 50 cm. long and 25 cm. wide. Cones 10–12 cm. long. In the lower forest with *Rhododendron*, *Quercus*, *Pinus*, etc. Tsangpo Gorge at Gompo Ne, 1500–2100 m., Dec. 12, 1924. 6386.

Berberis ? aristata DC. Syst. ii, 8.

Flowers golden yellow. Bush of 2–3 m. in thickets on the exposed flank of the gorge of the Tsang-po at Gyala, July 10, 1924. 5962.

Berberis concinna Hook. fil. Bot. Mag. t. 4744.

Dwarf shrub, more or less prostrate with ascending branches, rising only about 15 cm. above the ground. Berries pendent, single, scarlet and polished, very conspicuous in the long grass in which the plant grows. Found on steep sunny slopes where the soil is very poor in the Tsang-po Gorge, 2100 m., Nov. 29, 1924. 6326.

Berberis ? pallens Franch. Pl. Delav. 36. (No fruits.)

Flowers golden yellow in pendent racemes. Bush of 30 cm. in thickets. Tsela Dzong, 3000 m., May 31, 1924. 5724.

Berberis Silva-Taroucana Schn. in Sargent Pl. Wilson. i, 359.

Flowers pale yellow. Bush of 2 m. in thickets by the river. Tumbatse, 3400–3600 m., July 13, 1924. 5936.

Berberis virescens Hook. fil. in Bot. Mag. t. 7116.

Flowers bright yellow, stems red. A large bush of 2–4 m. in height in thickets or shaded slopes by streams. Tsang-po Valley below Tsetang, 3000–3400 m., April 29, 1924. 5632.

Var.?

A compact almost dwarf bush 50–120 cm. high. Flowers bright yellow, stems not red. Leaves prickly. In thickets and amongst rocks, growing with No. 5632, of which it is perhaps a scrub variety. Tsang-po Valley below Tsetang, 3000–3400 m., April 29, 1924. 5633.

Berberis sp. n.? (aff. *B. mekongensi* W. W. Sm.).

Flowers pale yellow, leaves a beautiful glaucous blue. Shrub of 2–3 m. growing on the shrub-clad slopes among *Rhododendron* in more or less open situations. Temo La, 3900–4200 m., June 13, 1924. 5773.

Berberis (§ *Wallichianae*) ? **pruinosa** Franch. in Bull. Soc. bot. Fr. xxxiii, 387, but no flowers or fruit with specimen.

Scrub plant 30 cm. high growing in masses around the marshes in *Rhododendron* thickets and alder copse. Berries blue-black, pendent. Pemako chung, 2400–2700 m., Nov. 21, 1924. 6308.

Berberis sp. n.?

Flowers orange, solitary. A low-growing matted under-shrub rising only 15–20 cm. above the ground, on the open hillside with dwarf *Rhododendron, Juniperus, Lonicera, Potentilla fruticosa,* etc. Nyima La, 4200–4500 m., June 20, 1924. 5811.

BERBERIS sp. (*Indet.* without flowers or fruit.)

Small bushy undershrub up to 30 cm. high. Berries borne singly on pedicels 2·5 cm. long, dangling, bright coral-pink. On steep south-facing slopes amongst scrub *Rhododendron* etc. Leaves scarlet in October. Doshong La and Pemako, 3000–3600., Oct. 20, 1924. 6233.

MAHONIA NAPAULENSIS DC. Syst. ii, 21. (=*M. acanthifolia* G. Don.)

Shrub, unbranched, 3–5 m. in height, in forest. Flowers bright yellow. Tsangpo Gorge at Gompo Ne, 1500–1800 m., Dec. 9, 1924. 6374.

CORYDALIS CHRYSOSPHÆRA Marquand & Shaw sp. n. ex affinitate *C. mucroniferæ* Maxim., *C. Boweri* Hemsl. et *C. Hendersoni* Hemsl. sed a prioribus floribus majoribus bracteas foliosque multo superantibus, a postrema ovulis paucioribus c. 4 nec 10 inter alia differt.

Herba perennis glabra, pulvinum hemisphæricum densum vix 5 cm. altum efformans e radice singulo robustiore ortum. *Folia inferiora* glaucescentia longipetiolata ; petiolo usque 3·0 cm. longo, 1–2 mm. lato ; lamina ovata 1 cm. diametro biternatisecta, segmentis ultimis oblongo-ovatis, 1–3 mm. longis, c. 1 mm. latis, aristatis. *Folia superiora* et *bracteæ* glaucescentia anguste usque late spathulata apice laciniata, laciniis c. 5 mm. longis longe aristatis. *Flores* racemosi, racemis numerosis brevibus condensatis folia bracteasque excedentibus, conspicui, "læte lutescentes petalis apice nigris." *Pedunculus* 1–2 cm. longus. *Calyx* minutus, sepalis duobus subreniformibus, c. 0·5 mm. longis, 1 mm. latis, crenulato-dentatis luteis. *Corolla* usque 1·5 cm. longa ; petalo superiore lanceolato-naviculiforme dorso late alato, limbo subacuto petalis lateralibus spathulatis connato, calcari leviter curvato limbo sublongiore ; petalo inferiore ovale c. 5 mm. longo margine valde incurvato. *Fasciculi staminales* basi dilatati subovati, c. 1·5 mm. lati. *Appendix nectarifera* calcaris dimidium æquans. *Ovarium* glabrum ovoideum ovula c. quatuor continens. *Stylus* basi acute recurvatus, c. 5 mm. longus. *Fructus* non visi.

S.E. TIBET: On slate screes and earth banks. Atsa, 4500–4800 m., Aug. 27, 1924, *F. Kingdon Ward* 6152.

CORYDALIS FLACCIDA Hook. fil. & Thoms. Fl. Ind. i, 260.

Flowers purple. On the gravel banks of streams under trees. Tumbatse, 3600 m., July 10, 1924. 5928.

CORYDALIS LUPINOIDES Marquand & Shaw sp. n. affinis *C. junceæ* Wall. sed foliis caulinibus compositis petalo inferiore basi saccato inter alia differt.

Herba perennis glabra. *Radices* fasciculatæ anguste fusiformes, 1·5–2·5 cm. longæ. *Caules* complures erecti, usque 23 cm. alti. *Folia radicalia* nulla. *Folia caulina inferiora* triternata, segmentis oblanceolatis subobtusis, 5–10 mm. longis, petiolo 5–8 mm. longo. *Folia caulina superiora* singula

vel bina, remotissima triternata subsessilia basalibus consimilia sed minora. *Inflorescentia* elongata racemosa terminalis, usque 10 cm. longa. *Bracteæ superiores* simplices ovatæ, vix 5 mm. longæ; *inferiores* in folia transeuntes. *Flores* pallide violacei. *Pedunculus* c. 5 mm. longus. *Calyx* minutissimus, sepalis mox deciduis. *Corolla* c. 12 mm. longa; petalum superius dorso concavum petalis lateralibus spathulatis apice nigris connatum, limbo late lanceolato, c. 6 mm. longo, dorso alato; calcari subrecto lanceolato subacuto limbo æquilongo; petalum inferius obovato-lanceolatum, ad apicem acutum late carinatum. *Fasciculi staminales* attenuati vix 0·5 mm. lati. *Ovarium* fusiforme; ovulis compluribus usque numerosis. *Stylus* apice resimus. *Stigma* insigniter quadrifidum. *Fructus* non visi.

S.E. TIBET: In shady pastures and thickets. Tumbatse, 3600 m., July 4, 1924, *F. Kingdon Ward* 5900.

CORYDALIS MEIFOLIA Wall. Tent. Fl. Nip. 52, t. 41, var. CORNUTIOR Marquand & Shaw var. nov. affinis var. *sikkimensi* Prain sed calcari laminam petali postici subæquante differt.

Flowers dull yellow, leaves glaucous with a purplish tinge. On slate screes. Atsa Pass, Tibet, 4800 m., Aug. 27, 1924, *F. Kingdon Ward* 6163.

CORYDALIS SCABERULA Maxim. Fl. Tangut. 40, t. 24, figs. 1–11.

Flowers pale yellow, tipped with black. On slate screes. Atsa Pass, 4800–5100 m., Aug. 27, 1924. 6162.

CORYDALIS WARDII Marquand & Shaw sp. n. ex affinitate *C. Delavayi* Franch. sed floribus minoribus calcari multo breviore foliolis latioribus minus attenuatis inter alia differt.

Herba perennis glabra. *Radices* fusiformes fasciculati, 1·5–3·0 cm. longi. *Caules* singuli usque quaterni erecti, usque 25 cm. alti, 2–3 mm. diametro, efoliosi fere usque ad inflorescentiam. *Folia radicalia* perpauca (in hoc specimine unicum), petiolo 8–15 cm. longo, gracili, lamina biternata, segmentis ultimis oblanceolato-ellipticis acutis, 0·5–1·5 cm. longis. *Folia caulina* solum caulis florentis apicem versus edita haud plus quam 6 cm. ab inflorescentia; petiolo 1–2 cm. longo, basi applanato vaginante; lamina ei folii radicalis consimili, magis decomposita, segmentis usque 2·5 cm. longis. *Inflorescentia* solitaris terminalis breviter racemosa. *Flores* lutei. *Pedunculi* usque 7 mm. longi. *Calyx* minutus; sepalis subreniformibus denticulatis. *Corolla* 9–11 mm. longa; petala superiori dorso concavo, carina lata, limbo lanceolato-acuto, calcari recto lato obtuso limbi circiter dimidium æquante; petalis interioribus obovatis oblongis obtusis apice connatis, "apicibus atropurpureis"; petalo inferiore oblongo-lineari apice carinato, dimidio apicali pendulo. *Fasciculi staminales* basin versus dilatati c. 1 mm. lati. *Appendix*

nectarifera duabus partibus calcaris æquilonga. *Ovarium* obovoideum ovulis numerosis. *Stylus* apice resimus. *Fructus* non visi.

S.E. TIBET: In open sheltered situations on the bush-clad mountain side, amongst rocks, etc. Doshong La, 3400–3600 m., June 18, 1924 (*F. Kingdon Ward*). 5865.

ARABIDOPSIS HIMALAICA (Edgew.) O. E. Schulz in Engl. Pflanzenr. iv, 105. 283.

Flowers white, tinged mauve. In mud or gravel of ditches. Tumbatse, 3600 m., July 10, 1924. 5927.

DRABA ALPINA Linn. Sp. Pl. 642.

Flowers brilliant egg-yellow. On screes and open alpine earth slopes. Rong-chu (east range), Tumbatse, 4500 m., June 18, 1924. 5803.

DRABA ELATA Hook. fil. & Thoms. in Journ. Linn. Soc. v, 150.

Flowers bright golden-yellow. Growing up amidst dwarf *Rhododendron* and other shrubs on grassy alpine slopes, abundant. Nyima La, 4200–4500 m., June 20, 1924. 5812.

DRABA INVOLUCRATA W. W. Sm. in Notes Roy. Bot. Gard. Edin. xi, 206.

Flowers bright yellow. Forming small clumps or cushions on the gneiss cliffs and boulder screes. Sang La, 4500–4800 m., July 8, 1924. 5915.

DRABA LASIOPHYLLA Royle Illustr. Bot. Himal. 71.

In fruit on gneiss cliffs at Atsa, 4200 m., Aug. 28, 1924. 6169.

COCHLEARIA SCAPIFLORA Hook. fil. & Thoms. in Journ. Linn. Soc. v, 154.

Petals white with bluish-green claws and veining. Rather unpleasantly scented. In alpine valleys by streams, deeply rooted in damp loamy soil. Rong-chu (east range), Tumbatse, 4200–4500 m., June 18, 1924. 5804.

BRAYA ROSEA Bunge Del. Sem. Hort. Dorp. 8.

Flowers white. On earth and boulder screes, rock ledges, etc. Sang La, 4500–4800 m., July 8, 1924. 5916.

? BRAYA ROSEA Bunge Del. Sem. Hort. Dorp. 8, *forma*. (Identification uncertain in the absence of fruit.)

Flowers white. On earth slopes amongst screes, growing with 6016. Nam La, 4500 m., July 26, 1924. 6017.

? BRAYA sp. (Identification uncertain in the absence of fruit.)

Flowers purple. On earth slopes amongst the screes. Nam La, 4500 m., June 27, 1924. 6016.

Iberidella tibetica Marquand & Shaw sp. n. ex affinitate *I. Andersoni* Hook fil. & Thoms. sed fructibus immaturis duplo vel triplo brevioribus cymbiformibus habitu robustiore differt.

Herba perennis subcæspitosa. *Radices* densæ fibrosæ. *Caules steriles* brevissimi. *Folia* caulium sterilium numerosa conferta suborbicularia petiolata, lamina 4–6 mm. diametro, petiolo lamina longiore. *Caules florentes* complures, usque 15 cm. longi, erecti vel adscendentes robusti teretes purpurascentes glabri. *Folia caulina* laxa alterna sessilia glabra ovata subcordata integra vel obscurissime dentata, 8–11 mm. longa, c. 5 mm. lata. *Inflorescentia* racemosa elongata terminalis, racemo secundario interdum e folii supremi axilla oriente racemum primarium excedente. *Flores* "albi vel violascentes vel pallide violaceo-tincti." *Sepala* ovata, apice obtuso, margine lato hyalino, basi subsaccata, c. 2 mm. longa, 1 mm. lata. *Petala* obovata unguiculata, 4–5 mm. longa, c. 3 mm. lata, apice rotundato vel retuso. *Stamina* libera ; filamentis subæquilongis robustioribus filiformibus. *Ovarium* ellipsoideum glabrum. *Stylus* brevis simplex. *Fructus* (immaturus) cymbiformis, 4–5 mm. longus, tetragonus glaber stylo persistente.

S.E. Tibet : From the alpine pastures, amongst dwarf *Rhododendron* and scrub, to the alpine turf. Nyima La, 4200–4500 m., June 21, 1924, *F. Kingdon Ward* 5827.

Viola Delavayi Franch. in Bull. Soc. bot. France, xxxiii, 413.

Flowers bright orange with a few dark guide lines in the centre. By streams and irrigation channels on grassy banks. Lusha, 2600 m., May 19, 1924. 5684.

Viola dissecta Ledeb. Fl. Ross. i, 244.

Flowers scentless, dark or pale. On open lawns, banks or stone walls, under bushes, etc., near villages and cultivation. Tsang-po valley below Tsetang, 3000–3400 m., April 29, 1924. 5630.

Viola glaucescens Oudem. in Miq. Ann. Mus. Bot. Lugd. Bat. iii, 74. (= *Viola distans* Wall. var. *acaulis* Hook. fil. & Thoms.)

Flowers white, with fine purple lines and blotches. In *Picea* forest, Lusha, 10 miles east of Tsela Dzong on the north flank of the Himalaya, 3000 m., May 18, 1924. 5677.

Lychnis atsaensis Marquand sp. n. *L. Wardii* Marquand affinis sed foliis obtusis stylis filamentisque longioribus inter alia differt.

Herba perennis. *Caulis* ad 15–18 cm. altus. *Rami* adscendentes plures virides glanduloso-pubescentes ex caulis nodis radicalibus 5–7 cm. longis aptis. *Folia* basi congesta obovata-cuneata vel oblanceolata petiolata

3–5 cm. longa, 1–1·5 cm. lata, apice obtusa utrinque breviter pubescentia. *Flores* plerumque 2, terminales. *Pedicelli* 2–2·5 cm. longi glanduloso-pubescentes. *Calyx* sub-cylindricus leviter inflatus c. 2 cm. longus; 0·8–1 cm. diam. in nervis coccineus et glanduloso-pubescens, inter nervis incolorus; lobi 3–3·5 mm. longi, sinus acutus. *Petala* alba, intra violacea, glabra 3-nervis lamina irregulariter lobata, 2-squamata calycem excedentia; squamæ reniformes imbricatæ. *Stamina* c. 2·5 cm. longa, filamenta glabra nisi quod basi dense-pubescentia; antheræ ovoideæ c. 1·5 mm. longæ. *Styli* 5, glabri 6–8 mm. longi. *Fructus* non visus.

S.E. Tibet: 4200–4500 m., Aug. 27, 1924. In barren stony soil in the dry gullies at Atsa, *F. Kingdon Ward* 6150.

Lychnis namlaensis Marquand sp. n. inter *Wahlbergellas* ex affinitate *L. tristis* Bunge sed calyce longiore foliis caulinis subsessilibus inter alia differt.

Herba perennis. *Caulis* erectus ad 32 cm. altus, dense glanduloso-pubescens, basi purpureus. *Folia inferiora* non visa, statu florente ut vitetur nulla. *Folia caulina* lanceolata acuta 3–7 cm. longa, sessilia, utrinque glanduloso-pubescentia basi purpurea. *Flores* terminales, solitarii, primum erecti, deinde sub-penduli. *Pedicelli* crassi glanduloso-pubescentes, c. 5 cm. longi. *Calyx* sub-cylindricus 2·5 cm. longus 1·0 cm. latus extra purpureo-striatus et glanduloso pilosus, intra albidus, dentibus triangularibus subacutis leviter recurvatis, 3–4 mm. longis. *Corolla* violacea haud dilatata, petalis conspicue 3-nervis; squamæ 2, irregulariter lobulatæ. *Filamenta* glabra. *Styli* 5. *Fructus* non visus.

S.E. Tibet: Moraines, Nam La, eastern extremity of Himalaya, 4500 m., July 27, 1924, *F. Kingdon Ward* 6024.

The material of this plant is unfortunately very scanty, only one flower being nearly expanded, the remainder in young bud. Although undoubtedly closely allied to the Siberian *L. tristis* Bunge, that species is distinguished from the present plant by the sub-ovoid less glandular-pubescent calyx and stem-leaves gradually narrowed at the base.

Lychnis rubricalyx Marquand sp. n. ex affinitate *L. atsaensis* Marquand sed floribus minoribus calyce ovoideo foliisque insigniter differt.

Herba perennis. *Caules* erecti purpureo-pubescentes 12–14 cm. alti. *Caudex* irregulariter stoloniferus. *Folia inferiora* 2·5–3 cm. longa, spathulata, late-petiolata; lamina 0·7–1 cm. lata cum petiolo parce pilosa. *Folia caulina* pauca, elliptica subsessilia 1–2 cm. longa, pilosa. *Bracteæ* dense pilosæ, vix 0·8 cm. longæ. *Flores* terminales, solitarii vel bini. *Pedicellus* supremus 2·5–3 cm. longus dense glanduloso-pubescens. *Calyx* leviter inflatus, basi sub-truncatus, coccineus, glandloso-pubescens, tubus 1–1·3 cm, longus, 1 cm. latus, nervi 10 sub-inconspicui, lobi 3–3·5 mm. longi, 4·5–5 mm. lati, ungue ±deltoideo. *Petala* purpurea calycem longe excedentia, ungue 3-nervo sub ipso limbo irregulariter lobulato vel inciso lateraliter expanso. *Squamæ* distinctæ vel ±confluentes. *Filamenta* basi tomentosa. *Styli* 5, 8–9 mm. longi. *Fructus* non visus.

S.E. Tibet: On granite cliffs, Nambu, 3400–3600 m., Aug. 13, 1924, *F. Kingdon Ward* 6086.

The margins of the lamina and sides of the petiole are fringed with multicellular hairs c. 2 mm. long; upper and lower surface also sparsely clothed with hairs.

Lychnis Wardii Marquand sp. n. ex affinitate *L. nigrescentis* Edgew. sed foliis latioribus et petalis 1-squamatis inter alia longe differt.

Herba perennis. *Caudex* nonnihil crassus. *Caules* ascendentes, numerosi, 10–12 cm. alti, supra dense glanduloso-pubescentes. *Folia caulina* subsessilia, ovato-lanceolata, acuta 2–3 cm. longa 1–1·5 cm. lata utrinque pubescentia. *Flores* terminales solitarii vel interdum bini. *Pedicellus* 1·5–2 cm. longus, dense glanduloso-pubescens. *Calyx* 2–2·5 cm. longus, subovoideus, subinflatus, purpureus, nervi 10 dense glanduloso-pubescentes, lobi lati obtusi 4–5 mm. longi, sinus ±acutus. *Petala* pallide violacea, bilobata, infra 3-nervia basi pubescentia multicellulari vestita. *Squamæ* confluentes erosæ fimbriatæ sub-triangulares petalo æquilatæ, lobi c. 2 mm. longi, sinus latus. *Stamina* 8–10 mm. longa; filamenta subulata, supra glabra, infra pubescentia; antheræ ovoideæ 1·2–1·4 mm. longæ. *Styli* 5, brevissimi (vix 1·5 mm. longi). *Fructus* non visus.

S.E. Tibet: On gravel screes on the Tra La. 4200 m., Aug. 2, 1924, *F. Kingdon Ward* 6041.

Cerastium alpinum Linn. Sp. Pl. 438.

Flowers white. In gravel in the dry open stream bed. Lusha, 3000 m., May 18, 1924. 5678.

Brachystemma calycinum D. Don Prod. Fl. Nep. 216.

Petals white, sepals cream. In thickets, E. Bhutan, 26° 0′ N., 92° 0′ E., 1200 m., Feb. 22, 1925. 6450.

Arenaria Delavayi Franch. in Bull. Soc. bot. France, xxxiii, 432,

Flowers white. On earth screes and on steep grassy slopes in sheltered places. Nam La, 4200–4500 m., July 24, 1924. 5991.

Arenaria glanduligera Edgew. in Hook. fil. Fl. Brit. Ind. i, 240.

Flowers deep crimson. On gravel beds and on alpine turf slopes, where it forms small cushions. Pa-sum-kye La, 4500 m., Aug. 25, 1926. 6132.

ARENARIA MELANDRYOIDES Edgew. in Hook. fil. Fl. Brit. Ind. i, 241.

Flowers pinkish purple; filaments and style violet; anthers purple. Stem and calyx dusky purple. On glacier moraines. Nam La, 4500–4800 m., July 24, 1924. 5983.

ARENARIA RAMELLATA Williams in Journ. Linn. Soc. xxxviii, 399.

Flowers dead white. On the grassy banks of streams, where it forms dense tufts. Pa-sum-kye La, 4500 m., Aug. 25, 1924. 6131.

ARENARIA STRACHEYI Edgew. in Hook. fil. Fl. Brit. Ind. i, 240.

Flowers snow-white, leaves very pale sea-green. On grassy ledges and slopes of gneiss cliffs. Nam La, 4200–4500 m., July 26, 1924. 6019.

MYRICARIA WARDII Marquand sp. n. ex affinitate *M. prostratæ* Benth. & Hook. fil. sed altior floribus multo minoribus sepalisque brevissimis insigne differt.

Frutex 2 m. altus. *Cortex* griseo-brunneus. *Rami* recti. *Folia* lineari-lanceolata, sessilia (in specimine sicco, facile decidua) sub-incurva, c. 2 mm. longa. *Racemi* sub-laxi 3–5 cm. longi laterales vel terminales. *Bracteæ* purpureæ lanceolateæ acuminatæ 3–4 mm. longæ. *Flores* parvi. *Pedicelli* 1·5–2 mm. longi. *Sepala* lanceolata acuta 1·5 mm. longa. *Petala* libera anguste-obovata 4 mm. longa pallide purpurea. *Stamina* 10 monadelphia, 5 longiora et 5 breviora, filamenta attenuata inæqualiter connata. *Gynæcium* 2·5 mm. longum; stigmata 3, sessilia; ovarium pyriforme, apice attenuatum. *Fructus* non visus.

The leaves are sage-green with minute dots composed of crystals of salt exuded from pores on the lower surface.

S.E. TIBET: Growing in the sand along the margins of pastures in the river-bed at Tsela Dzong, 2900 m., May 28, 1924, *F. Kingdon Ward* 5708.

GERANIUM POLYANTHES Edgew. & Hook. fil. in Fl. Brit. Ind. i, 431.

Flowers purplish crimson. In boggy pastures. Doshong La, 3000–3400 m., June 28, 1926. 5864.

IMPATIENS ARGUTA Hook. fil. & Thoms. in Journ. Linn. Soc. iv, 137.

Flowers pale violet, orange inside the throat. In the lower forest, open situations, meadows, etc. Tra La, 3400–3600 m., July 31, 1924. 6035.

IMPATIENS CRISTATA Wall. in Roxb. Fl. Ind. ed. Carey, ii, 456.

Flowers pale yellow. In ditches, in the sheltered lanes of the villages in the Tsang-po valley below Pe, 2700–3000 m., July 28, 1924, *F. Kingdon Ward* 6013.

IMPATIENS FRAGICOLOR Marquand & Shaw sp. n. a speciebus affinibus *I. sulcata* Wall., *I. Thomsoni* Hook. fil. and *I. uliginosa* Franch. præcipue labelli forma recedens.

Planta glaberrima erecta, usque 60 cm. alta. *Caulis* simplex robustus tetragonus succulentus statu vivo politus. *Folia* inferne opposita superne alterna petiolata lanceolata rarius ovato-lanceolata acuminata serrata basi cuneata, 3·5–6·0 cm. longa, 1·5–3·0 cm. lata ; petiolo 0·5–3·0 cm. longo; glandulis stipularibus conspicuis pulvinatis. *Pedunculi* pauci (usque 5 vel 7) ex axillis superioribus subcorymbose dispositi folia æquantes vel subexcedentes graciles 1–6-flori; pedicellis 5–17 mm. longis, apice incrassatis ; bracteis usque 6 mm. longis, lanceolatis acuminatis. *Flores* expansi 20–25 mm. longi. *Sepala* duo peroblique ovata acuminato-cuspidata subcordata, 6–7 mm. longa, 4 mm. lata. *Vexillum* cordato-ovatum apice latissimo obtuso vel retuso costa inconspicua ecalcarata. *Alæ* sessiles, usque 2 cm. longæ : lobo basali rotundato mucronato basi constricto, 8 mm. longo, 5 mm. lato ; lobo distali c. 14 mm. longo, 5–6 mm. lato, marginibus parallelis apice cuneato obtuso. *Labellum* infundibulare usque 27 mm. longum, calcari gracili valde incurvato in limbum sensim ampliato ; fauce adscendente supra acuta. *Filamenta* 2–4 mm. longa, alata, infra antheras geniculata et dilatata ; antheris obtusis. *Ovarium* rectum acuminatum, 4–5 mm. longum. *Capsula* recta acuminata, c. 20 mm. longa, 3 mm. lata.

S.E. TIBET : In shaded pastures by the river. Tumbatse, 3600 m., July 10, 1924, *F. Kingdon Ward* 5924.

“ Flowers crushed-strawberry-and-cream colour ” (*F. K. W.*).

IMPATIENS NYIMANA Marquand & Shaw sp. n. ex affinitate *I. oxyantheræ* Hook. fil. pubescentia foliis crenatis inflorescentia pluriflora alarum deinque forma inter alia differt.

Caulis simplex gracilior, 2–4 dm. altus, glaber internodiis supremis brevissimis exceptis. *Folia* 2·0–5·5 cm. longa, alterna breviter petiolata, supremis subsessilibus vel sessilibus, membranacea ovata vel interdum ovato-lanceolata acuminata grossius crenata omni crenatione margine anticali prope ipsum sinum cuspidem minutam gerente, utraque pagina sparse et breviter hispida, basi in petiolum 3–7 mm. longum angustata. *Pedunculi* 2–5-(rarius 1-)flori foliis breviores graciles supremis tenuiter pubescentibus; pedicellis 1·0–1·2 cm. longis supra basin bracteatis ; bracteis ovato-lanceolatis acuminatis 3–5 mm. longis. *Flores* expansi 2·2–2·8 cm. longi, “ albi vel ochroleuci, intra faucem flavi, brunneo-maculati.” *Sepala* duo ovata vel subcymbiformia cuspidata, 5 mm. longa, 3 mm. lata. *Vexillum* orbiculare, 8 mm. diametro, costa vix carinata sed in cuspidem brevem apicalem recurvatam producta. *Alæ* sessiles, 17–20 mm. longæ, lobo basali rotundato vel vix angulato integro haud cuspidato ; lobo distali submajore oblique acuminato margine adversus sinum inter lobos incrassato. *Labellum* subsaccatim infundibulare; limbo 15–18 mm. longo in calcar breve 5–7 mm. longum obtusum valde incurvatum abruptiuscule angustato. *Filamenta* alata, ala altero latere sub anthera in cuspidem obtusam dilatata. *Antheræ* cordatæ obtusæ. *Ovarium* fusiforme acuminatum. *Capsula* (vix matura) linearis.

S.E. TIBET: On the banks of streams and in the forest in damp ground, shaded; abundant. Chu-nyima, 3000 m., Aug. 9, 1924, *F. Kingdon Ward* 6067.

ZANTHOXYLUM OXYPHYLLUM Edgew. in Trans. Linn. Soc. xx, 42, *forma*.

Hook-climber growing many feet in length in the forest. Fruit a 3-locular capsule with two polished black seeds in each loculus. Abundant in the Tsang-po Gorge, 2400 m., Nov. 23, 1924. 6312.

ILEX AQUIFOLIUM L. Sp. Pl. 125, ? var. CASPIA Loes.

In mixed forest. Tong-kyuk, 2700 m., Aug. 10, 1924. 6070. Capt. F. K. Ward notes "I saw a few trees crowded with scarlet berries but it does not appear to seed freely. Distributed through the gorge." Tsang-po Gorge, 2400–2700 m., Nov. 20, 1924. 6298. No berries with the dried specimen.

ILEX PERNYI Franch. Pl. David. i, 69.

Berries scarlet. Forming compact cushions on ledges of gneiss cliffs. Doshong La (Pemako), 3400–3600 m., Oct. 22, 1924. 6240.

EUONYMUS RONGCHUENSIS Marquand & Shaw sp. n. ex affinitate *E. porphyreæ* Loesener sed floribus pentameris fere triplo majoribus præcipue differt.

Frutex gracilis, 2–3 m. altus, apice nutans vel subpendulus. *Rami* subteretes tenuiter quadrisulcati glabri. *Folia* plerumque opposita raro alterna membranacea lanceolata vel oblongo-lanceolata acuminata, 3·5–5·5 cm. longa, 1–2 cm. lata, margine tenuissime et regulariter crenulato-serrato; petiolo c. 3 mm. longo. *Inflorescentia* perpauciflora. *Pedunculi* per paria bina opposita sub ipso pari foliorum decussatim orientes, graciles, usque 4·5 cm. longi. *Pedicelli* duo vel tres, umbellati, 5–10 mm. longi. *Flores* pentameri, c. 1·4 cm. diametro, atro-rubentes. *Sepala* late rotundata, c. 1·5 mm. longa, reticulate venosa. *Petala* obovata cuneata, 5–6 mm. longa, 3·0–3·5 mm. lata. *Discus* 5-lobata, c. 2 mm. diametro. *Staminum* antheræ in foveolis disci sessiles. *Ovarium* minutum. *Fructus* non visi.

S.E. TIBET: In *Picea* forest, forming part of the scanty undergrowth with species of *Lonicera* and *Deutzia* on heavily moss-clad slopes. Rongchu, Tumbatse, 3900 m., June 16, 1924, *F. Kingdon Ward* 5791 (type).

Flowers dull red, over. Small tree of 5–6 m. in mixed *Picea-Rhododendron* forest, where bamboos grow, 3600 m., July 18, 1924, *F. Kingdon Ward* 5951.

EUONYMUS TALIENSIS Loes. in Notes Roy. Bot. Gard. Edin. viii, 3.

Flowers cream, tinged red on the outside. Growing on steep rocky slopes, amongst scrub *Rhododendron*. Doshong La, 3400–3600 m., June 29, 1924. 5873.

EUONYMUS VERRUCOSOIDES Loes. in Engl. Jahrb. xxx, 462.

In fruit. In thickets by the river, gorge of the Tsang-po, Gyala, 2700 m., July 20, 1924. 5964.

CELASTRUS HOOKERI Prain in Journ. As. Soc. Beng. lxxiii, 197.

Fruits orange, seeds scarlet. In thickets and forest on the ridge above Gompo Ne, Tsang po Gorge, 1800 m., Dec. 17, 1924. 6356.

RHAMNUS LEPTOPHYLLUS C. K. Schneider in Notizbl. Bot. Gart. Berlin, 1908, 77.

Bush 5–10 ft. (1·5–3·0 m.) high and nearly as much through. Flowers yellowish green. On rocky granite boulder slopes and cliffs with *Sophora* etc. Chake, Tsang-po Valley below Nang Dzong, 3000–3400 m., May 4, 1924. 5647.

TETRASTIGMA SERRULATUM (Roxb.) Planch. in DC. Mon. Phan. v, 2, 432, var. SUBOBTECTUM Kurz (sub *Vitis serrulata*) in Journ. As. Soc. Beng. xliv, 173.

In fruit. Berries black. Thickets by the river, Tsang-po Valley, 2100–2400 m., Nov. 28, 1924. 6319.

ACER CAUDATUM Wall. Plant. As. Rar. ii, 4, var. UKURUNDUENSE (Trautv. & Mey.) Rehd. in Sarg. Trees and Shrubs, i, 164, t. lxxxii. Doshong La, 3000–3600 m., June 23, 1924, and in fruit in the forests of the Nyima La, July 1, 1924. 5832.

ACER STACHYOPHYLLUM Hiern in Hook. fil. Fl. Brit. Ind. i, 694.

Tree of 10 m. in fruit. In mixed forest above the river; gorge of the Tsang-po, near Gyala, 2700–3000 m., July 19, 1924. 5956.

DOBINEA VULGARIS Buch.-Ham. ex D. Don Prod. Fl. Nep. 249.

On granite rocks, in shady thickets by the river. Tsang-po Gorge, Gompo Ne, 1500 m., Dec. 7, 1924. 6357.

PIPTANTHUS BOMBYCINUS Marquand sp. n. *P. tomentoso* Franch. affinis sed leguminibus immaturis longe albo-pilosis et floribus majoribus differt.

Frutex usque 2–3 m. altus. *Rami* primo pubescentes deinde glabri, ± teretes. *Folia* trifoliata; petiolo 6–8 mm. longo; foliolis lanceolatis acuminatis 4–5 cm. longis, 1·5 cm. latis, pagina superiore pilis gracilibus adpressis sparse vestita; stipulis acutis, 6–7 mm. longis, externe dense villosis. *Inflorescentia* tomentosa, internodiis usque 1 cm. (et ultra) longis sursum increscentibus. *Bracteæ* late ovatæ, 6–9 mm. longæ, apice subacuto usque rotundato. *Pedicellis* 1·5–2 cm. longis. *Calyx* 12–15 mm. longus, usque medium quadrifidus; lobis acutis extra villosis intus pubescentibus, inferiore reflexo, superiore apice bifido (e sepalis duobus coalitis constante). *Corolla* læte flava; vexillo orbiculari emarginato, 2 cm. diametro, basi in unguem angustum c. 4 mm. longum 0·5–1·0 mm. latum contracta; alis 18 mm. longis, 8 mm. latis, auriculatis, in unguem 5 mm. longum angustatis; carina 22 mm. longa, auriculis longis. *Legumina* juniora dense villosa, matura non visa.

S.E. TIBET: In thickets by streams in the Tsang-po Valley east of Nang Dzong, 3000–3400 m., May 6, 1924, *F. Kingdon Ward* 5652 (type).

This plant differs from all the species of the genus hitherto described in the adpressed hairs being sparsely scattered on the upper surface and densely villose on the lower surface of the leaf. The flowers are markedly larger than those of *P. tomentosus* Franch. From *P. nepalensis* Don it is easily distinguished by the leaves. The species was collected before by the Tibet Frontier Commission in 1904, *E. H. Walsh* 56.

INDIGOFERA PSEUDOTINCTORIA Matsum. in Bot. Mag. Tokyo, xvi, 62.

Flowers light crimson. Shrub of 2–3 m. in thickets with *Ceratostigma*, *Desmodium*, etc. Gorge of the Tsang-po, near Gyala, 2700 m., July 21, 1924. 5967.

CARAGANA CRASSISPINA Marquand sp. n. *C. bicolori* Kom. and *C. Franchetianæ* Kom. affinis sed a priore tubo calycis multo longiore floribusque majoribus, ab altera spinis crassioribus alis 1-auriculatis differt.

Frutex solidus, 60–120 m. altus. *Rami* recti, primum pubescentes. *Internodia* c. 1 cm. longa. *Stipulæ* late ovatæ apice spina 4–5 mm. longa præditæ. *Spinæ petiolares* robustæ, 2·5–3 cm. longæ, basi 2 mm. diametro. *Folia* c. 2 cm. longa, plerumque 5-juga. *Foliola* obovata-lanceolata acuminata 7–8 mm. longa, pagina superiore glabrescente pagina inferiore pubescente. *Calyx* subsaccatus villosus; tubo 1 cm. longo, 4–5 mm. lato; dentibus acutis 3–4 mm. longis. *Vexillum* "plus minusve ochraceum vel fusco-aurantiacum," c. 2 cm. longum, lamina suborbiculari basi in unguem attenuata. *Alæ* "læte flavæ," lamina c. 12 mm. longa, 4 mm. lata, basi 1-auriculata, auricula curvata unguem linearem c. 6 mm. longum subexcedente. *Carina* læte flava laminæ basi late auriculata. *Tubus staminalis* glaber. *Ovarium* cum styli parte inferiore dense villosum. *Fructus* non visus.

S.E. TIBET: Forming much of the thorn scrub on the exposed flank of the hill at Tsela Dzong, 2900–3200 m. Just coming into flower, May 29, 1924, *F. Kingdon Ward* 5710.

The petiolar spines of this plant although shorter than those of *C. Franchetiana* are nearly twice their diameter and the internodes only about half the length of those in that species; the flowers are also quite distinct in the wing-petals of the present species having a single long auricle whereas in *C. Franchetiana* there is a second shorter auricle on the other side of the basal claw.

CARAGANA JUBATA Poir. Encyc. Suppl. ii, 89.

Low-growing bush, with *Rhododendron lacteum* and *Potentilla fruticosa* on the sunny side of the lake, on gravel and gneiss slopes. Nam La, 4200 m., Nov. 6, 1924. 6267.

CARAGANA TIBETICA Kom. in Act. Hort. Petrop. xxix, 286, *forma.*

Flowers bright yellow like gorse, rather darker. Forms low spreading bushes 60–120 cm. high with very much the habit of gorse.' In sand on steep rocky slopes above the Tsang-po, growing with other thorn scrub 20 miles east of Tsetang, Tibet, 3500 m., April 24, 1924. 5620.

GUELDENSTAEDTIA HIMALAICA Baker in Hook. fil. Fl. Brit. Ind. ii, 117.

Flowers violet. Growing in the drier pastures. Rong-chu, Tumbatse, 3600–3900 m., June 17, 1924. 5797.

ASTRAGALUS LESSERTIOIDES Benth. ex Bunge Astrag. i, 24.

Nam La, Tibet, 4200–4500 m., July 24, 1924. With 5982.

ASTRAGALUS TATSIENENSIS Bur. & Franch. in Morot Journ. de Bot. v, 23.

Flowers bright canary-yellow. On slate screes and on steep grassy slopes. Atsa Pass, 4800–5100 m., Aug. 27, 1924. 6159.

ASTRAGALUS TRIBULIFOLIUS Benth. ex Bunge Astrag. ii, 2, var. PAUCIFLORUS Marquand & Shaw var. nov. a typo differt inflorescentibus 1–3-floris foliolis brevioribus subtruncatis.

Flowers purple with darker guide lines and a small white area at the base of the standard. On dry open scrub-clad and rocky slopes, deeply rooted in sandy or gravelly soil. Tsela Dzong, Tibet, 2700–3000 m., May 22, 1924, *F. Kingdon Ward* 5692.

ASTRAGALUS TUMBATSICA Marquand & Shaw sp. n. subgeneris *Phacæ* sectionis *Cenantri* (*Nigricantium* N. D. Simpson), *A. florido* Benth. ex Bge. peraffinis, sed calycis dentibus duplo brevioribus sinubus latis sejunctis, foliolis usque quadruplo latioribus satis differt.

Herba suffrutescens perennis. *Caules* "adscendentes, usque 2–3 ft. [0·6–0·9 m.] alti" (teste F. K. W.); parte inferiore non lecta; parte superiore 2–3 mm. diametro, striata, cum petiolis pedunculisque tenuissime subnigro-pubescente, parce ramosa. *Folia* usque 10 cm. longa, 7–9-juga; foliolis elliptico-oblongis usque 2 cm. longis, 0·9 cm. latis, apice obtuso truncato vel retuso, pagina superiore glaberrima viridi, pagina inferiore pilis brevibus albidis adpressis densiuscule vestita. *Racemi* patentes, pedunculis usque 8 cm. longis suffultis; floribus quindecim usque triginta plus minusve secundi laxiusculi. *Pedicelli* dense subnigro-pubescentes erecti basi articulati, c. 2 mm. longi. *Calyx* subcylindraceus, tenuiter subnigro-pubescens, 2–3 mm. diametro, tubo c. 5 mm. longo, dentibus triangulari-acutis, vix 1 mm. longis, sinubus latioribus obtusis sejunctis *Corolla* "ochraceo-lactea, nonnunquam surde rubro-suffusa." *Vexillum* oblongum retusum, 1·2–1·3 cm. longum, 0·5 cm. latum. *Alae* c. 1·2 cm. longæ; ungue gracili limbo sublongiore; limbo auriculato, c. 2 mm. lato. *Carina* c. 1·2 cm. longa, unguiculata bi-auriculata. *Stamina* diadelpha, c. 1·8 cm. longa, apice resima. *Ovarium* stipitatum anguste fusiforme glabrum; stylo simplici curvato gracili. *Ovula* pauca (c. quatuor). *Fructus* non visi.

S.E. TIBET: Forming massive plants in the meadow which lines cultivated fields. Tumbatse, 3400 m., Aug. 5, 1924, *F. Kingdon Ward* 6057.

ASTRAGALUS YUNNANENSIS Franch. Pl. Delav. 162.

Flowers dull yellow, turning dusky purple gradually as they age. On grassy scrub-clad alpine slopes. Nam La, 4200–4500 m., July 24, 1924. 5982.

OXYTROPIS LAPPONICA Gaud. Fl. Helvet. iv, 543, var. XANTHANTHA Baker in Hook. fil. Flor. Brit. Ind. ii, 137.

Flowers pale sulphur-yellow. In gravel by the river. Druk-la Gompa, 3600 m., Aug. 23, 1924. 6119.

OXYTROPIS YUNNANENSIS Franch. Pl. Delav. i, 163.

Flowers violet. In open pastures and on turf slopes. Nam La, 4200 m., July 23, 1924. 5980. Flowers violet. On grassy alpine slopes, facing south. Atsa Pass, 4200–4500 m., Aug. 27, 1924. 6156.

DESMODIUM TILIÆFOLIUM G. Don Gen. Syst. ii, 297, var. GENUINUM Schindler in Fedde Repert., xxii, 265

Nyima La, Tibet, 4200–4500 m., June 21, 1924. 5825.

VICIA SATIVA Linn. Sp. Pl. 736.

Flowers purple. In pastures in the valley bottom. Tsela Dzong, 2800 m., May 28, 1924. 5709.

APIOS MACRANTHA Oliver in Hook. Icon. Pl. xx, t. 1946.

Twiner, with cream flowers, tipped with violet. In thickets on the open flanks of the valley. Gorge of the Tsang-po, 2400–3000 m., July 19, 1924. 5961.

CAJANUS INDICUS Spreng. Syst. iii, 248.

E. BHUTAN: 26° 30′ E., 91° 30′ N., 1500 m., Feb. 19, 1923. 6429.

SOPHORA MOORCROFTIANA Benth. ex Baker in Hook. fil. Fl. Brit. Ind. ii, 249.

Flowers deep violet, the lower half of the "standard" cream. Forming a thin scrub covering gravel chutes, sand-dunes and dry rocky slopes in the river-bed. Tsang-po Valley, below Tsetang, 3000–3600 m., April 30, 1924. 5637.

First seen at Gyantse, 4200 m. Extends all down the Tsang-po Valley from Tsetang to below Tsela Dzong, where it was just beginning to flower at the end of May. On May 24 there were still many seeds lying about under the bushes not yet beginning to germinate.

ALBIZZIA sp.? aff. *A. Julibrissin* Durazz. (*Indet.* without flowers.)

In fruit. Tree of 10–12 m. branched towards the summit, branches spreading out more or less fanwise. In rather open situations in the forest fringing the river bank. Tsang-po Gorge at Gompo Ne, 1400 m., Dec. 10, 1924. 6380.

PRUNUS cf. P. CINERASCENS Franch. in Nouv. Archiv. Mus. Paris, sér. 2, viii, 216, *e descr.*

Single wild cherry. Flowers white. Small tree of 6–12 m. abundant in thickets by the river. Bloom passing over. Rong-chu, Tumbatse, June 19, 1924. 5806.

PRUNUS FRUTICOSA Pallas Fl. Ross. i, 19.

Flowers white, without scent. Shrub or small tree in villages along the valley. Tsela Dzong, 2900 m., May 15, 1924. 5676.

This is a most interesting extension in the range of this species which is distributed through Europe and parts of Siberia.

PRUNUS LATIDENTATA Koehne in Sargent Pl. Wilson., i, 217.

Flowers white, without scent. Small tree of 10 m. in shaded ravines and sheltered valleys where forest grows. Tsela Dzong, 3000–3400 m., May 16, 1924. 5690.

PRUNUS RUFA Steud. Nom. ed. 2, ii, 402.

Flowers pink. In the alpine region with scrub *Rhododendron* and descending to the beginning of the forest region where it grows with birch, willow, maple, etc. Doshong La, 3400–3600 m., June 29, 1924. 5871.

PRINSEPIA UTILIS Royle Illustr. Bot. Himal. 206.

In thickets along the cliffs by the river. Tsang-po Gorge, 2100–2400 m., Nov. 28, 1924. 6320.

SPIRÆA BELLA Sims Bot. Mag. t. 2426.

Flowers white, smelling like Meadow-sweet. Small lax shrub with diffuse wiry stems in thickets by streams and on the sheltered wooded flank of the hill. Tsela Dzong, 3000 m., May 31, 1924. 5721.

RUBUS CALOPHYLLUS C. B. Clarke in Journ. Linn. Soc. xxv, 19, t. 7.

Fruits orange, tasteless. On steep rocky slopes in thickets and forming a thick bush in the Tsang-po Gorge at an altitude of 2100 m., Nov. 28, 1924. 6321.

POTENTILLA AMBIGUA Cambess. in Jacquem. Voy. Bot. 51, t. 52.

Flowers bright lemon-yellow. Forms continuous carpets over piles of stones etc. Tumbatse, 3400 m., Aug. 5, 1924. 6051.

POTENTILLA ERIOCARPA Wall. ex Lehm. Nov. Stirp. Pug. iii, 35, var. DISSECTA Marquand & Shaw var. nov. a typo distincta habitu humiliore cæspitoso, foliis sericeo-pubescentibus sublaciniatim angustisectis segmentis elliptico- vel lineari-lanceolatis.

S.E. TIBET: Flowers golden yellow. Forms big cushions on the gneiss cliffs and on the screes. Nam La, 4200–4500 m., July 27, 1924, *F. Kingdon Ward* 6011.

In Herb. Kew., *Hooker*, alt. 14,000 ft., and *Ribu & Rhomoo* 5276, both from SIKKIM, as well as *Forrest* 14,440 from YUNNAN, all belong to this variety.

POTENTILLA EUXANTHA W. E. Evans MS. sp. n. to be published soon in Notes Roy. Bot. Gard. Edin.

Flowers bright yellow. Forming much of the flower carpet on open sunny alpine turf slopes. Temo La, 4000–4200 m., Oct. 4, 1924. 6217.

POTENTILLA FRUTICOSA Linn. Sp. Pl. 495.

Flowers bright orange, just opening. On the sheltered flank of the mountain. Tsela Dzong, 3400 m., May 29, 1924. 5712.

Var. GRANDIFLORA Marquand var. nov. a typo differt floribus majoribus petalis ad 18 mm. longis 16 mm. latis.

S.E. TIBET: Flowers very large, golden orange. A low-growing scrub plant, not rising above 2 feet [60 cm.], associated with dwarf *Rhododendron* on alpine moorland. Temo La, 4200–4500 m., June 13, 1924, *F. Kingdon Ward* 5774.

POTENTILLA MICROPHYLLA D. Don Prod. Fl. Nep. 231.

Flowers golden yellow. Cushion plant. On rocks and alpine turf slopes, on stony ground. Nyima La, 4500–5200 m., June 21, 1924. 5826. "The roots are spirally twisted round each other, forming a main tap root."

POTENTILLA MONANTHES Lindl. ex Lehm. Nov. Stirp. Pug. iii, 33, var. SIBTHORPIOIDES Hook. fil. Fl. Brit. Ind. ii, 358.

Flowers bright yellow. Growing in colonies, forming mats (often with *Hemiphragma heterophyllum*) under the bushes; or scattered over alpine pastures. Kongbo Peri, 4000–4500 m., May 26, 1924. 5704.

SPENCERA PARVIFLORA Stapf in Bot. Mag. sub t. 9007.

Flowers bright yellow. In open well-drained meadows and around cultivated fields. Pasum Lake and Pasum La, 3000–3600 m., Aug. 17, 1924. 6103.

ROSA MOYESII Hemsl. & Wils. in Kew Bull. 1906, 159.

Doshong La, 2700–3000 m., and common on both sides of the Tsang-po, 2700–3400 m., June 23, 1924. 5834.

ROSA SERICEA Lindl. Ros. Monog. 105, t. 12, *var.* (without fruit).

Medium-sized compact bush 1·5–3 m. high. Flowers pale cream, fragrant. Tsang-po Valley, below Tsetang, 3000–3400 m., April 29, 1924. 5631.

ROSA SWEGINZOWII Koehne in Fedde Rep. viii, 22, var. INERMIS Marquand & Shaw var. nov. aculeis caulinibus petiolaribusque minimis vel perpaucis, receptaculis pedicellisque aculeis omnino carentibus a typo distincta.

S.E. TIBET: In fruit. Bush of 6 ft. (2 m.) in hedges and thickets. Pasum Lake, 3000–3300 m., Aug. 17, 1924. In flower. Flowers white. Foliage scented. Fruits scarlet, smooth. Near Druk-la Gompa, 3300 m., Aug. 23, 1924. Widely distributed on both sides of the Tsang-po, *F. Kingdon Ward* 6101 (type).

WESTERN SZE-CHUAN: Sungpanting, 3000 m., Aug. 1910, *E. H. Wilson* (Arn. Arb. Exp.), 4028. *Ibid.*, Oct. 1910, *E. H. Wilson* 4028*.

ROSA sp. (*Indet.* without flowers.)

Scrambling 6–10 m. up trees in the rain-forest of the Tsang-po Gorge, below Pemako-chung, 2400 m., Nov. 23, 1924. 6309.

? SORBUS REHDERIANA Koehne in Sargent Pl. Wilson. i, 464, *var.* ? (but without flowers or fruit).

In the forest a small tree up to 10 m., but dwarfed in the Alpine region. Doshong La, 3400–3600 m., Oct. 17, 1924. 6230.

MALUS sp. n.? aff. *M. spectabilis* Borkh. (Material insufficient for diagnosis in the absence of fruit.)

Flowers white flushed pink. Fragrant. Cultivated in the villages of the Tsang-po Valley, east of Tsetang, 3000–3400 m., April 30, 1924. 5638.

COTONEASTER MULTIFLORA Bunge in Ledeb. Fl. Alt. ii, 220.

Flowers white. In the thickets and woods on the sheltered flank of the hill. Tsela Dzong, 3000 m., May 31, 1924. 5722.

SAXIFRAGA ATRATA Engl. in Bull. Acad. Pétersb. xxix, 117.

Petals white, ovary and stamens dull red. In open situations, amongst scrub *Rhododendron* etc. Nyima La, 3900–4200 m., June 22, 1924. 5824.

SAXIFRAGA BERGENIOIDES Marquand sp. n. ex affinitate *S. viscidula* Hook. fil. & Thoms. et *S. Lychnitidis* Hook. fil. & Thoms. sed ab utraque specie floribus purpureis inter alias notas insigniter differens.

Caules cæspitosi, 8–12 cm. alti, simplices, tomento laxo ferrugineo vestiti. *Folia radicalia* elliptica longipetiolata; lamina ferrugineo-tomentosa, 1–2 cm. longa, 5–8 mm. lata, apice obtuso; petiolo etiam tomentoso laminam æquante, vix 1 mm. lato. *Folia caulina* 3–4 ovata-lanceolata sessilia caulis apicem versus decrescentia, 8–15 mm. longa, 3–5 mm. lata, sparse ferrugineo-tomentosa. *Flores* terminales solitarii penduli vel subcernui. *Pedunculus* crassiusculus sub ipsum florem dense tomentosus. *Sepala* ovata haud reflexa, 5–6·5 mm. longa, 4–5 mm. lata, superficie glabrescente margine breviter ciliato. *Petala* purpurea obovato-oblanceolata unguiculata 1·2–1·5 cm. longa, 4–5 mm. lata, 5–7-nervia, apice rotundata. *Stamina* petalis dimidio breviora; filamentis subulatis glabris, antheris globosis c. 0·8 mm. diametro. *Ovarium* glabrum ovoideum. *Styli* breves. *Stigmata* capitata.

S.E. TIBET: Amongst boulders and on cliffs on the exposed side of the mountain. Sang La, 4500–4800 m., July 8, 1924, *F. Kingdon Ward* 5912. Also noted on the Nam La, 4200 m., July 23, 1924.

SAXIGRAGA CAVEANA W. W. Sm. in Rec. Bot. Surv. Ind. iv, 193.

Flowers golden yellow with orange spots. Cushion-plant of the gneiss cliffs. Nam La, 4500 m., July 26, 1924. 6013.

SAXIFRAGA DIAPENSIA H. Sm. in Act. Hort. Gothob. i, 10.

Flowers pale sulphur-yellow with gamboge spots. In clumps on damp moss-clad slopes near water, facing north. Sung La (Temo La), 4500 m., Oct. 2, 1924. 6214.

SAXIFRAGA FLAGELLARIS Willd. ex Sternb. Rev. Saxifr. 25, t. 6.

A form with aristate cauline and basal leaves otherwise agreeing with var. *euflagellaris* Engl. & Irmsch. Flowers bright yellow. Scattered plants on grassy slopes, amongst cliffs and screes on the Nam La, 4500 m., July 26, 1924. 6018.

SAXIFRAGA GAGEANA W. W. Sm. in Rec. Bot. Surv. Ind. iv, 265.

Petals white tinged pink, anthers orange. On steep moss-clad slopes in *Abies* forest. Nyima La, 3600–3900 m., July 1, 1924. 5889.

SAXIFRAGA GYALANA Marquand & Shaw sp. n. ex affinitate *S. Vilmoriniana* Engl. & Irmsch. sed foliis linearibus obtusis sepalis haud reflexis satis dispar.

Planta cæspitosa. *Caulis* erectus superne ramosus, 9–10 cm. altus, pilis glanduliferis brevibus ubique densiuscule vestitus. *Folia basalia* numerosa conferta rosulata linearia obtusa, 5–7 mm. longa, c. 1 mm. lata, margine fimbriato. *Folia caulina* sparsa sessilia lineari-oblanceolata, 4–6 mm. longa, c. 1 mm. lata, apice obtuso, margine pilis glanduliferis obsito. *Inflorescentia* subcorymbosa 6–9-flora; bracteis minutis ovatis; pedunculis gracilibus dense glanduloso-pilosis. *Sepala* haud reflexa glabra, præter marginem serie unica pilorum brevium glandulosorum obsitum, ovata obtusa c. 1·5 mm. longa. *Petala* aureo-flava immaculata oblanceolato-ovata subacuta conspicue trinervia breviter unguiculata, 5–6 mm. lata. *Filamenta* dimidium petalorum superantia, subulata; antheris minutis globosis caducis. *Ovarium* ovoideum c. 2·5 mm. longum in *stylos* glabros fere 1 mm. longos attenuatum. *Stigmata* globosa. *Fructus* non visi.

S.E. TIBET: On gneiss cliffs and rocks on the sheltered side of the river at Gyala, gorge of the Tsang-po, 2700 m., July 20, 1924, *F. Kingdon Ward* 5963.

SAXIFRAGA HETEROTRICHA Marquand & Shaw sp. n. affinis *S. sediformi* Engl. & Irmsch. sed rosulæ foliis eglandulosis setoso-cinctis pedunculis gracilioribus elongatis recedit.

Caulis solitarius erectus gracilis, 8–10 cm. altus, ubique glanduloso-pubescens superne ramosus. *Folia basalia* numerosa rosulata oblongo-spathulata, usque 1 cm. longa, 1–2 mm. lata, margine hyalino setoso-ciliato,

apice subobtuso. *Folia caulina* c. 1·5 cm. supra basin exorsa, ovata sessilia, 4–6 mm. longa, 2–3 mm. lata, apice obtuso, margine pilis brevissimis glanduliferis obsito, superficie glabra. *Inflorescentia* subcorymbosa laxa 4–14-flora; pedunculis gracilibus divaricatis glanduloso-pubescentibus. *Calyx* minutus; sepalis reflexis ovatis glabris, 1–1·5 mm. longis, apice subobtuso. *Corolla* læte flava; petalis lineari-oblanceolatis, 4–5 mm. longis, 1–1·5 mm. latis, apice subacuto; nervis tribus, nervo medio plus minusve nigro-suffuso. *Filamenta* lineari-subulata, c. 3 mm. longa. *Antheræ* pallide luteæ subglobosæ. *Ovarium* elliptico-ovoideum stamina æquans. *Styli* breves. *Stigmata* capitata. *Fructus* non visi.

S.E. TIBET: On mossy rocks in the woods bordering the Pasum Lake, 3000 m., Aug. 18, 1924, *F. Kingdon Ward* with 6111.

SAXIFRAGA HISPIDULA D. Don in Trans. Linn. Soc. xiii, 380.

Flowers golden yellow. On schistose rocks in the forest, just coming into flower. Tang La, 3600 m., July 18, 1924. 5952. One specimen approaching var. *Doniana* Engl. (Mon. Gatt. Sax. (1872) 222).

Flowers deep orange, stems and calyx covered with crimson glandular hairs. On grassy well-drained banks under trees, facing south. Tumbatse, 3400 m., Aug. 6, 1924. 6058. One or two specimens showing an approach to var. *Doniana* Engl. (loc. cit.)

Var. DENTATA Franch. in Nouv. Arch. Mus. Par. sér. 2, viii, 232.

Flowers golden yellow, nodding. On turf slopes and rocks, in clumps. Nam La, July 23, 1924. 5979.

SAXIFRAGA HOOKERI Engl. & Irmsch. in Engl. Jahrb. xlviii, 582, var. ÆQUIFOLIA Marquand & Shaw var. nov. a typo differt foliis caulinibus minoribus subæquilongis ad 1 cm. longis foliis basilaribus sub-rosulescentibus breviter petiolatis.

Flowers orange. On top of the open hillside. Tumbatse, Tibet, 3400 m., Aug. 7, 1924, *F. Kingdon Ward* 6059.

SAXIFRAGA IMBRICATA Royle Illustr. Bot. Himal. 226, t. 49.

Petals green; anthers bright yellow. Forming compact cushions on cliffs and rock-ledges, on the more sheltered side of the gneiss cliffs. Sang La, 4500–4800 m., July 8, 1924. 5914.

SAXIFRAGA JACQUEMONTIANA Decne in Jacquem. Voy. Bot. 68, t. 78, fig. 2.

Flowers orange, petals turning brick red on the outside later. On moraines and cliffs. Nam La, 4500–4800 m., July 24, 1924. 5990.

The highest flowering plant noticed here, extending to over 16,000 feet on the gneiss cliffs overlooking the pass.

SAXIFRAGA KINGDONII Marquand sp. n. ex affinitate *S. latifloræ* Hook. fil. & Thoms. aqua habitu petalis rotundatis foliis minoribus subrotundatis differt.

Planta perennis. *Radices* densi. *Caules* numerosi adscendentes eramosi, 8–12 cm. longi, pilis glanduliferis sparse tomentosi. *Folia* sessilia late elliptico-ovata usque subrotundata, 1–2·5 cm. longa, 0 8–1·5 cm. lata, apice obtuso, utraque pagina pilis sparsis obsita, marginibus costaque infra densius hirsutis, pagina inferiore superiore pallidiore. *Flores* terminales solitarii. *Pedunculus* 1–2 cm. longus, glanduloso-pilosus. *Calyx* externe glanduloso-pilosus; sepalis ovatis, 6–8 mm. longis, 4–5 mm. latis. *Corolla* aureo-lutea maculis aurantiacis; petalis rotundatis 5–7 mm. diametro, nervis 7. *Stamina* petalis paullo breviora; filamentis subulatis glabris; antheris reniformibus. *Ovarium* subglobosum. *Stylus* brevis. *Stigma* capitatum. *Fructus* non visus.

S.E. TIBET: Under rocks on the boulder screes, and on cliffs facing north. Tang La, 4500 m., Sept. 20, 1924, *F. Kingdon Ward* 6195.

The shape of the petals and leaves distinguish this species from *S. latiflora* Hook. fil. & Thoms., which is moreover apparently a less tufted plant.

SAXIFRAGA MEGALANTHA Marquand sp. n. Species affinis *S. brachypoda* Don. sed humilior foliis latioribus floribus majoribus nutantibus pedunculis brevioribus petali sobovatis usque 10 mm. longis, 6 mm. latis, rubro-glandulosocinctis.

Planta cæspitosa. *Caules* adscendentes, 5–7 mm. longi, inferne glabri, superne glanduloso-pilosi. *Folia* ovata acuminata, sursum increscentia usque 9 mm. longa et 5 mm. lata in parte caulis superiore, margine breviter et regulariter spinuloso-dentato, dentibus sæpe apice glanduliferis; pagina inferiore superiore pallidiore, papyracea. *Flores* magni solitarii terminales nutantes. *Pedunculus* c. 4 mm. longus glanduloso pilosus. *Calyx* purpureus, extra pilis glanduliferis densissime vestitus, sepalis late ovatis, 5–7 mm. longis, 3–4 mm. latis. *Corolla* aureo-lutea petalis suborbicularibus unguiculatis, 6–7 mm. diametro, ungue c. 2·5 mm. longo, 1 mm. lato, toto margine glandulis stipitatis rubris in serie singula cincto. *Stamina* dimidium petalorum vix æquantia. *Stylus* minus quam 1 mm. longus. *Fructus* non visus.

S.E. TIBET: On turf slopes and rocks in clumps. Nam La, eastern extremity of the Himalaya, 4200 m., *F. Kingdon Ward* 5979.

This species is very distinct from *S. brachypoda* Don and the var. *fimbriata* (Wall.) Engl. & Irmsch. The beautiful fringe of red glands on the petals which is so striking in this plant, is absent from the type specimen of *S. brachypoda* in Herb. Wall. and from all other material of that species in Herb. Kew., except two among a gathering from 3600 m. at

Dotha, *Rohmoo Lepcha* 177. The stems are shorter without axillary buds and with the leaves more dense and much broader proportionally.

SAXIFRAGA MONTANA H. Sm. in Act. Hort. Gothob. i, 9.

Forma HUMILIS H. Sm. l. c. 10.

Flowers orange. Tufted plant growing on shaded gneiss rocks. Nam La, 4200–4500 m., July 25, 1925. 6002. Flowers bright yellow with pale orange spots. On shady banks. Pa-sum-kye La, 4200 m., Aug. 24, 1924. 6144.

Var. SUBDIOICA (Hook. fil.) Marquand comb. n.

Flowers orange red. On grass slopes on the gneiss cliffs facing south on the Nam La, 4200–4500 m., July 26, 1924. 6012.

SAXIFRAGA MURICOLA Marquand & Shaw sp. n. ex affinitate *S. pasumensis* sed foliis apice rotundatis petalis 2–3-plo longioribus pallide albo-lutescentibus differt.

Caulis solitarius brevis, 3·5–5·0 cm. altus, sparse glanduloso-pubescens. *Folia basalia* glabra dense rosulata spathulata, c. 2 cm. longa ; lamina suborbiculari, 3–3·5 mm. lata, margine hyalino pectinato, apice sæpe reflexo; petiolo 2–2·5 mm. lato. *Folia caulina* lineari-lanceolata glanduloso-pubescentia, inde a basi augescentia usque 2 cm. longa, 2 mm. lata. *Inflorescentia* multiflora corymbosa pseudo-umbellata, 6–8 cm. longa ; pedunculis gracilibus glanduloso-pubescentibus circa medium bifurcatis atque bibracteatis. *Calyx* glanduloso-pubescens ; sepalis lanceolatis acutis, 5–6 mm. longis. *Petala* " pallide sulphurea lineis fuscioribus," oblanceolata subobtusa, 1·1–1·3 cm. longa, leviter recurvata trinervia. *Stamina* dimidium petalorum vix attingentia ; filamentis subulatis ; antheris luteis subquadratis. *Styli* longi. *Fructus* maturi non visi.

S.E. TIBET : On cliffs and old walls of gneiss, where there is not much other vegetation, abundant near the Pasum Lake, 3000 m., Aug. 19, 1924, *F. Kingdon Ward* 6112.

Var. BRACHYPETALA Marquand & Shaw var. nov. a typo differt inflorescentia multum ramosiore floribus minoribus petalis obovatis apice rotundatis 7–8 mm. longis, 3–4 mm. latis. Growing with the type of the species, *F. K. W.* 6112.

Var. QUINQUENERVIS Marquand & Shaw var. nov. a typo differt inflorescentia pauciflora petalis latioribus c. 10 mm. longis 4·5 mm. latis quinquenervibus pedunculis robustioribus. Also growing with the type, *F. K. W.* 6112.

SAXIFRAGA PALLIDA Wall. in Sternb. Saxifrag. Suppl. t. 23 ; DC. Prodr. iv, 38.

Petals white ; anthers and calyx dull red. In half-shaded pastures by the river, Rong-Chu, Tumbatse, 3600 m., June 15, 1924. 5789.

SAXIFRAGA PASUMENSIS Marquand & Shaw sp. n. affinis, ut videtur, et *S. umbellulatæ* Hook. fil. & Thoms. formæ *pectinatæ*, et *S. sanguineæ* Franch., sed ab illa foliis rosularibus subacutis inflorescentia subcandelabriformi, ab hac petalis luteis latioribus, et ab utraque floribus multum numerosioribus differt.

Caulis solitarius erectus ubique glanduloso-pubescens, 7–8 cm. altus, c. 3 cm. supra basin in inflorescentiam amplam corymbosam caulem excendentem ramificatus. *Folia basalia* dense rosulata lineari-spathulata subacuta glabra, 1–1·5 cm. longa, 1·5–2·5 mm. lata, margine apicali breviter pectinato. *Folia caulina* sessilia oblanceolata, 1–1·3 cm. longa, 2–3 mm. lata, glanduloso-pubescentia. *Rami inflorescentiæ* ex axillis foliorum caulinum angulo 45–60° orientes. *Bracteæ* lineari-lanceolatæ, c. 5 mm. longæ. *Flores* numerosissimæ læte flavæ. *Calyx* glanduloso-pubescens : sepalis lineari-lanceolatis acutis, c. 3 mm. longis, haud reflexis. *Petala* oblanceolata obtusa, 7–8 mm. longa, 2–2·5 mm. lata ; nervis tribus. *Stamina* dimidio petalorum breviora : filamentis subulatis ; antheris caducis. *Ovarium* glabrum. *Stylus* brevis. *Fructus* non visi.

S.E. TIBET : On mossy rocks in the woods bordering the Pasum Lake, 3000 m., Aug. 18, 1924, *F. Kingdon Ward* 6111.

Forma GRACILIS Marquand & Shaw f. nov. a typo differt inflorescentia parva terminali. With 6111.

SAXIFRAGA PERPUSILLA Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 72.

Small cushion plant, growing on screes and rock-ledges on the gneiss cliffs. Flowers yellow without spots. Sang La, 4500–4800 m., July 8, 1924. 5913.

SAXIFRAGA PSEUDO-HIRCULUS Engl. in Engl. Jahrb. xlviii, 590.

Flowers bright yellow. On banks under bushes or rocks on the Pa-sum-kye La, 4200–4500 m., Aug. 25, 1924. 6127.

SAXIFRAGA PSEUDO-PALLIDA Engl. & Irmsch. in Engl. Jahrb. l, Beibl. 114, 40.

Petals white with a large orange blotch at the base. On grassy patches among the screes. Atsa (Pass), 4800 m., Aug. 27, 1924. 6164.

SAXIFRAGA PUNCTULATA Engl. in Engl. Jahrb. xlviii, 601.

Petals milk-white or bright yellow, spotted all over with crimson. On gravel banks. Pa-sum-kye La, 4500–4800 m., Aug. 25, 1924. 6128.

SAXIFRAGA SAGINOIDES Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 68.

On screes and rock-ledges on gneiss cliffs. Sang La, Tibet, 4500–4800 m., July 8, 1924. With 5913.

SAXIFRAGA SIGNATELLA Marquand sp. n. *S. signatæ* Engl. & Irmsch. affinis sed minor, petalis parte inferiore non abrupte angustatis.

Caulis erectus parum ramosus, 3–6 cm. altus, ubique pilis brevibus rigidis glanduliferis dense vestitus, atro-violaceus. *Folia basalia* rosulata (rosula parva densa vix 1 cm. diametro) spathulata, 4–6 mm. longa, lamina orbiculari-ovata vel rhomboidea glabra margine dentibus minutis hyalinis triangularibus prædito. *Folia caulina* laxiuscula lanceolato-spathulata sessilia, 4–7 mm. longa, 1–1·5 mm. lata, marginibus paginaque superiore pilis purpureis glanduliferis denso obsitis. *Flores* 1–6; pedicellis pilis glanduliferis densissime vestitis. *Sepala* oblongo-ovata obtusa 3–4 mm. longa pilos glanduliferos externe gerentia. *Petala* oblonga 5-nervia 7–8 mm. longa 2–3 mm. lata basi haud subito contracta alba vel purpureo-roseo-suffusa parte inferiore maculis parvis purpureis crebre obtecta. *Antheræ* surde rubro-aurantiacæ. *Ovarium* late ovoideum.

S.E. TIBET: On earth screes and scrub-clad slopes in deep gullies in sandy soil. Nam La, easternmost Himalaya, 4200–4500 m., July 24, 1924, *F. Kingdon Ward* 5986.

SAXIFRAGA STELLA-AUREA Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 72.

Tufted plant growing on gneiss cliffs in shade. Nam La, Tibet, 4200–4500 m., July 25, 1924. With 6001. Petals gamboge, spotted orange in the lower half. Forming dense mats and low cushions on the highest slate crags. Atsa (Pass), 5100–5400 m. The highest flowering plant seen. Aug. 27, 1924. 6165.

Var. CILIATA Marquand & Shaw var. nov. a typo differt foliis longius ciliatis pedicellis multoties brevioribus.

S.E. TIBET: Flowers golden yellow. Tufted cushion plant of the gneiss cliffs. Nam La, Tibet, 4500 m., July 26, 1924, *F. Kingdon Ward* 6014.

SAXIFRAGA TARAKTOPHYLLA Marquand & Shaw sp. n. ex affinitate *S. Vilmorinianæ* Engl. & Irmsch. sed foliis sæpe pseudo-verticillatis floribus paullo majoribus stylibus brevissimis differt.

Caules solitarii graciles erecti simplices vel superne subramosi, usque 10 cm. alti, eglandulosi. *Folia basalia* rosulata pauciora ovata petiolata; lamina 3–5 mm. longa, 1–2·5 mm. lata, glaberrima, apice obtuso, margine anguste hyalino in setas tres usque sex utrinque producto vel nonnunquam integerrimo; petiolo 3–6 mm. longo, latiusculo. *Folia caulina* pauciora, sparsa vel in pseudo-verticilla duo vel tria collecta, glabra sessilia lineari-lanceolata, 5–8 mm. longa, 1–1·5 mm. lata, apice obtuso vel raro subacuto. *Inflorescentia* 1–4-flora e verticillo foliorum supremo laxe ramosa. *Pedunculi* graciles pilis brevibus glanduliferis vestiti. *Calyx* reflexus; sepalis ovatis, c. 1·5 mm. longis, glabris. *Petala* læte flava oblanceolata obtusa, 5–7 mm.

longa, 1·5–2·5 mm. lata, trinervia. *Filamenta* gracilia glabra, c. 3 mm. longa; antheris rubro-aurantiacis globosis minutis caducis. *Ovarium* ovoideum, 2–2·5 mm. longum, glabrum. *Stylus* nullus vel brevissimus. *Fructus* maturi non visi.

S.E. Tibet: "A curious little plant showing relationship to the *Diptera* section." On gneiss boulders in the shade. Tra La, Tibet, 3900 m., Aug. 1, 1926, *F. Kingdon Ward* 6040.

Saxifraga umbellulata Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 71.

Flowers bright yellow, each petal with a few orange lines; just opening. Basal leaves more or less fleshy; scape and upper leaves more or less clad with crimson glandular hairs. On shaded rocks, amongst scrub, on the exposed flank of the mountain. Shallow-rooted in soil derived from granite. Tsela Dzong, 2800 m., June 1, 1924. 5727. On gneiss cliffs in shade. Nam La, 4200–4500 m., July 25, 1924. 6001.

Forma pectinata Marquand & Shaw f. nov. a typo differt foliis latius petiolatis margine regulariter crebroque pectinato.

S.E. Tibet: On mossy rocks in the woods bordering the Pasum Lake, 3000 m., Aug. 18, 1924, *F. Kingdon Ward*. With 6111.

Bergenia ligulata (Wall.) Engl. in Bot. Zeitschr. xxvi, 840.

Flowers white, buds pink; just coming into flower. On dry cliffs facing the sun, forming a thick rootstock from the apex of which spring the flowers and leaves. E. Bhutan, all down the valley of the Nyamjang Chu, 1500–2100 m., Feb. 21, 1925. 6445.

Bergenia purpurascens (Hook. fil. & Thoms.) Engl. in Verh. zool.-bot. Ges. Wien, xix, 549.

Flowers purple, nearly over; leaves leathery, polished. On rocky slopes among scrub *Rhododendron* on the Nam La, 3900–4200 m., July 23, 1924. 5978.

Hydrangea heteromalla D. Don Prod. Fl. Nep. 211, var. parviflora Marquand & Shaw var. nov. a typo differt floribus radiantibus duplo triplove minoribus.

S.E. Tibet: Flowers cream, neuter flowers white; slightly scented. Tree of 10 m. in mixed forest, on the sheltered slopes above Gyala, abundant. Gorge of the Tsang-po, 2700–3000 m., July 19, 1924. 5953.

Deutzia corymbosa R. Br. ex Royle Ill. Bot. Himal. i, 216.

Flowers pale pink. Shrub of 2 m. in forest, or in thickets lower down the valley. Nyima La, 3000–3400 m., July 1, 1924. 5886.

RIBES ALPESTRE Wall. ex Decne in Jacquem. Voy. Bot. 64, t. 75.

Bush of 2 m. growing in thickets and hedges with *Lonicera*, *Rosa*, *Hippophaë*, etc. Fruit orange-red, hard and sour, but very abundant. Tumbatse, Tibet, 3000–3400 m., Sept. 28, 1924. 6208.

RIBES GRIFFITHII Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 88.

Flowers dull brownish red. A tall untidy shrub reaching a height of 3–4 m. and then bending over. Lusha, Tibet, 3000–3400 m., May 18, 1924. 5681.

RIBES LURIDUM Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 87.

Flowers brownish red. Shrub of 2–3 m. in hedges and thickets in the Tsang-po Valley, near Tsela Dzong, 2700–3000 m., May 9, 1924. 5658.

RIBES sp. indet. (No flowers or fruit.)

Bush of 1–2 m. with long pendent spikes of bright scarlet fruit of good flavour. In thickets of birch, *Rhododendron*, etc. in the subalpine region just above the forest line. Pemako, 3000–3400 m., Oct. 21, 1924. 6235.

SEDUM CRASSIPES Wall. ex Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 99.

Flowers creamy green, without scent. Mixed up with dwarf *Rhododendron* in the open valley. Sang La, 4500 m., July 9, 1924. 5920.

SEDUM HUMILE Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 99.

Flowers cream, turning reddish later. Prostrate plant forming close mats on open turf banks; abundant on cliffs; valley above Pongkar, near Druk La Gompa, 3600–3900 m., Aug. 24, 1924. 6122.

SEDUM ROTUNDATUM Hemsl. in Hook. Ic. Pl. t. 2469, var. OBLONGATUM Marquand & Shaw var. nov. a typo differt foliis obovato-ellipticis apice irregulariter serrulatis.

Petals and sepals light crimson, anthers pale cream, follicles green. As the fruits ripen they turn deep crimson, slightly fragrant. On open steep boulder slopes, where it forms great billowy clumps as much as 2 ft. [60 cm.] high and 5 ft. [150 cm.] through.

S.E. TIBET: Sang La, 4500–4800 m., July 9, 1924, *F. Kingdon Ward* 5919.

SEDUM SMITHII Raymond-Hamet in Engl. Jahrb. l, Beibl. 112. 8.

Valley above Pongkar, 3600–3900 m., Aug. 24, 1924. With 6122.

SEDUM sp. n.? aff. *S. platysepalo* Franch. Specimens in fruit, too old for diagnosis.

"Flowers pale yellow." In sand and gravel, in the dry bed of the river. Tumbatse, 3000–3400 m., Sept. 29, 1924. 6211.

SEDUM sp. indet.:

Flowers over. On slate screes. On the Atsa Pass, Tibet, 4800–5100 m., Aug. 27, 1924. 6161.

DROSERA PELTATA Smith ex Willd. Sp. Pl. i, 1546, var. **LUNATA** C. B. Clarke in Hook. fil. Fl. Brit. Ind. ii, 425.

Flowers white, not quite open. On wet lawn-like pastures. Tumbatse 3400–3600 m., July 13, 1924. 5935.

CORYLOPSIS SINENSIS Hemsl. in Gard. Chron. xxxix, 18.

Flowers sulphur-yellow, in catkins. At present leafless. In forest, 26° 0′ N., 92° 0′ E. E. Bhutan, 2500–2700 m., Feb. 21, 1925. 6446.

BEGONIA GRIFFITHII Hook. fil. in Bot. Mag. t. 4984.

Flowers white, sometimes flushed pink, just beginning to open. Leaves dark glossy green with an irregular ring of pale green or white surrounding the dark centre. Reverse deep purplish red. On rocks and cliffs and in thick forest, 26° 0′ N., 92° 0′ E. E. Bhutan, 1500 m., Feb. 21, 1925. 6444.

BUPLEURUM LONGICAULE Wall. ex DC. Prodr. iv, 131.

A form of this very variable species with small acute bracteoles. Flowers chocolate. In dry pastures, under trees. Tumbatse, 3600 m., July 10, 1924. 5925.

PIMPINELLA TENERA Benth. ex Hook. fil. Fl. Brit. Ind. ii, 686.

Flowers white. In thick beds of moss in *Picea* forest. Pa La (Tra La), 3400 m., Sept. 26, 1924. 6202.

CORTIA HOOKERI C. B. Clarke in Hook. fil. Fl. Brit. Ind. ii, 702.

Petals and stamens white; fruits purplish black. Prostrate on earth slopes of the great screes. Nam La, 4500–4800 m., July 26, 1924. 6008.

PLEUROSPERMUM HOOKERI C. B. Clarke in Hook. fil. Fl. Brit. Ind. ii, 705.

Flowers white, only very young fruit. On alpine turf slopes, amongst dwarf *Rhododendron* etc. Tang La, 4200–4500 m., Sept. 20, 1924. 6191.

PLEUROSPERMUM AMABILE Craib & W. W. Sm. in Trans. Bot. Soc. Edin. xxvi, 154.

In fruit. On boulder screes and exposed alpine turf slopes. Tang La, 4500 m., Sept. 20, 1924. 6198.

ARALIA CISSIFOLIA Griffith ex Seem. in Journ. Bot. vi, 134.

In fruit. Undershrub of 1·5–2 m. Berries black, growing in open situations in the *Abies-Rhododendron* forest. Doshong La, 3400–3600 m., Oct. 17, 1924. 6231.

Aralia pseudo-ginseng Benth. ex C. B. Clarke in Hook. fil. Fl. Brit. Ind. ii, 721. =*Panax pseudo-ginseng* Wall.

In fruit (but no fruits with specimen). Berries black on top, scarlet beneath. Plant of 50–70 cm. in thickets and in forest, amongst *Juniperus* and *Picea*, Tumbatse, 3000–3400 m., Sept. 29, 1924. 6210.

Schefflera Wardii Marquand & Shaw sp. n. ex affinitate *S. Delavayi* (Franch.) Harms sed foliolis ovato-oblongis breviter caudatis sinuato-serratis dentibus utrinque 8–10, racemulis multo brevioribus, floribus subduplo majoribus longius pedicellatis distinctissima.

Folium quinatim digitatum; petioluli teretes, usque 17 cm. longi, c. 3 mm. diametro, primo stellato-tomentosi demum glabrescentes; *foliolum* late ovatum usque ovato-oblongum breviter caudatum, usque 35 cm. longum apice 3 cm longo incluso, margine sinuato-serrato dentibus subobtusis utrinque octo usque decem, basi truncato vel oblique subcordato; pagina superiore glabra, pagina inferiore dense stellato-tomentosa; nervis utrinque quinque usque octo, supra impressis infra prominentibus, adscendentibus, venis reticulum densum anastomosans efformantibus. *Inflorescentia* composite racemosa, tomento densissimo albido stellato vestita; ramulis usque 12 cm. longis, adscendentibus vel patulis, basi sine floribus. *Flores* ochraceo-lactei. *Pedicelli* c. 3 mm. longi, graciles, patentes. *Receptaculum* obconicum obscure obtuseque pentagonum, 2·5 mm. longum, 1·5 mm. diametro. *Calycis* limbus e dentibus quinque deltoideis breviter cuspidatis constans. *Petala* ovato-deltoidea, c. 2 mm. longa, 1 mm. lata. *Stamina* quinque; filamentis brevibus conduplicatis basi crassa parte apicali pendente tenerrima; antheris majusculis versatilibus loculis oblongis facile divulsis. *Styli* in conum brevem dispositi. *Ovarium* quinqueloculare. *Fructus* non visi.

"Slender tree about 25 ft. [c. 8 m.] high. Trunk unbranched, ending in a crown of immense palmate leaves from the centre of which springs a large terminal inflorescence—a compound raceme of cream-coloured flowers. An average leaf measured:—petiole 2 ft.; central leaflet, petiole 7½ in., blade 13½ in. long, 8 in. wide." [*F. K. W.*]

S.E. Tibet: "Common in the lower forest with other huge-leaved Araliaceæ." Tsang-po Gorge, near Gompo Ne, 1500–1800 m., Dec. 4, 1924, *F. Kingdon Ward* 6347.

Viburnum sp. (*Indet.* without flowers or fruit.)

Flowers white. Berries at first red, finally black. Shrub of 3–5 m., the leaves turning a wonderful ruddy orange in October. Scattered through the thick *Rhododendron* scrub. Doshong La, 3000–3400 m., Oct. 23, 1924. 6246.

VIBURNUM sp. (*Indet.* without flowers or fruit.)

Shrub or small tree with drooping branches, as much as 6 m. high. Berries dull scarlet in large pendent umbels. Tsang-po Gorge, at Gompo Ne, 1500–1800 m., Dec. 10, 1924. 6381. "The berries are eaten by the natives, but the flavour is very tart."

LONICERA CYANOCARPA Franch. in Journ. de Bot. x, 314.

Flowers pale yellow. Young shoots purple with a velvety sheen; juvenile leaves bluish green. Fruits blue-black. A dwarf spreading shrub not 60 cm. high, growing entangled amongst dwarf *Rhododendron*, on the open moorland. Sang La (Temo La), 4500 m., July 9, 1924. 5918.

Var. PORPHYRANTHA Marquand & Shaw var. nov. a typo differt corollis saturate purpureis paullo amplioribus, stylo staminibusque inclusis.

S.E. TIBET: Flowers deep purple, berries blue-black like large sloes. Undershrub of 30–60 cm. growing on steep rocky slopes amongst scrub *Rhododendron*. Doshong La, 3600–3900 m., June 29, 1924 *F. Kingdon Ward* 5872.

LONICERA HISPIDA Pall. ex Roem. & Schult. Syst. v, 258.

Flowers pale yellowish green. Slender shrub of 2 m. in *Picea* and *Rhododendron* forest. Rong-chu, above Tumbatse, 3600–3900 m., July 9, 1924. 5923.

Var. CHÆTOCARPA Batalin ex Rehder in Rep. Miss. Bot. Gard. xiv, 94.

Flowers sulphur yellow. Shrub of 1·5–2 m. Growing in the open valley by streams. Rong-chu, 3600–3900 m., June 13, 1924. 5776.

Var. SETOSA Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 166.

Flowers creamy yellow. Prostrate plant, growing on steep gravelly slopes, facing south. Nam La, 4200–4500 m., July 24, 1924. 5988.

LONICERA LANCEOLATA Wall. in Roxb. Fl. Ind., ed. Carey, ii, 177.

Flowers purple. Slender or bushy shrub, attaining a height of 3–4 m. in *Picea* forest, usually in fairly open situations. Tumbatse, 3600–3900 m., July 3, 1924. 5895.

LONICERA LITANGENSIS Batal. in Act. Hort. Petrop. xiv, 173.

Flowers straw-yellow, opening before the leaves are fully developed. A compact twiggy undershrub of 30–45 cm., growing amongst dwarf *Rhododendron* on the lee side of the hill in alpine moorland. Temo La, 4200–4500 m., June 7, 1924. 5753. "In the alpine valley it grows a little more freely, not quite so twiggy." [*F. K. W.*]

LONICERA MYRTILLUS Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 168.

Flowers white. Bushy shrub, 2–3 m. high. In shady wooded ravine at Chaka, Tsangpo Valley, below Nang Dzong, Tibet, 3600 m., May 4, 1924. 5645. Flowers white, more or less tinged with purple outside, fragrant. In gullies and woods at Tsela Dzong, 3400 m., May 29, 1924. 5715.

LONICERA OVALIS Batalin in Act. Hort. Petrop. xiv, 170, var. SUBCORIACEA Marquand & Shaw var. nov. a typo differt foliis paullo majoribus subcoriaceis superne glaberrimis bracteis subulatis ovarium paullo superantibus.

S.E. TIBET: Flowers pale yellow, berries orange-scarlet. Foliage sea-green, sometimes almost glaucous. Bush or small tree up to 15 or 20 ft. [c. 4·5–6·0 m.] high, in thickets or in alpine meadows. Amongst rocks. Pasum Lake, 3000–3600 m., Aug. 18, 1924 (*F. Kingdon Ward*). 6106.

LONICERA SETIFERA Franch. in Morot, Journ. de Bot. x, 314.

A thin weedy shrub, in fruit. Flowers yellow. Growing in thin undergrowth with oak scrub, *Rhododendron trifolium*, etc. Stem covered with sharp stiff hairs. In open pine forest. Lusha, 3000–4000 m., May 20, 1924. 5688.

LONICERA TOMENTELLA Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 167.

Flowers white, faintly flushed with pink or purple. A shrub of 1–2 m. In open but sheltered situations on the cliffs of the gorge. Nambu La, 3400–3600 m., Aug. 13, 1924. 6089.

LONICERA TRICHOPODA Franch. in Morot, Journ. de Bot. x, 317.

Flowers cream. Shrub of 1·5–2 m. On steep moss-clad slopes in heavy shade of conifer forest. Rong-chu, 3600–4200 m., June 13, 1924. 5775.

LONICERA WEBBIANA Wall. ex DC. Prod. iv, 336.

Flowers maroon-coloured. In *Picea* forest. Nyima La, 3400–4000 m., June 22, 1924. 5822.

LONICERA sp. indet. No flowers.

Twiner with clusters of polished black erect berries. In thickets and the more open parts of the forest, distributed through the gorge. Pemako-Chung, Tsang-po Gorge, 2400–2700 m., Nov. 20, 1924. 6294.

LEYCESTERIA FORMOSA Wall. in Roxb. Fl. Ind., ed. Carey, ii, 182, var. STENOSEPALA Rehder in Pl. Wils. i, 312.

Flowers white. Shrub of 2–3 m., in pine forest. Tongkyuk, 2400–2700 m., Aug. 11, 1924. 6077.

HAMILTONIA SUAVEOLENS Roxb. Hort. Beng. 15.

Flowers cobalt-blue, very fragrant. Shrub of 1–2 m. On dry slopes in niches of the cliff, or amongst grass. Trashigang Dzong, East Bhutan, 1500–1800 m., Feb. 16, 1925. 6425.

LEPTODERMIS SCABRIDA Hook. fil. Fl. Brit. Ind. iii, 199.

Flowers purple. Bush, compact and twiggy, 70–150 cm. high, growing in the driest parts of the Tsang-po Valley, 2700–3000 m., July 1, 1924. 5890.

MORINA BETONICOIDES Benth. in Hook. Icon. Pl. t. 1171.

A form with few marginal spines on the leaves. Flowers white, fragrant. In dry meadows on the edges of cultivation, in very sandy soil. Growing rankly among Umbelliferæ, *Thalictrum*, *Labiatæ*, grasses, etc. Tumbatse, 3600 m., July 3, 1924. 5894.

MORINA sp. n.? aff. *M. longifolia* Wall. ex DC. Prodr. iv, 644 Unfortunately in the absence of flowers this cannot be described adequately.

Plant of 25–40 cm. growing in dry scrub-clad slopes at Tsela Dzong in gritty soil, granite or gneiss, 2700–3000 m., Sept. 11, 1924. 6180. "Now in fruit with seeds mostly gone."

SCABIOSA HOOKERI C. B. Clarke in Hook. fil. Fl. Brit. Ind. iii, 218.

Flowers mauve-purple. In open meadows. Pa-sum Lake and Pass, 3000–3400 m., Aug. 17, 1924. 6104.

ASTER TIBETICUS Hook. fil. Fl. Brit. Ind. iii, 251.

Abundant in moist pastures with *Iris*, *Primula*, etc. Tumbatse, 3600 m., July 3, 1924. 5898.

ERIGERON MULTIRADIATUS (Lindl.) Benth. in C. B. Clarke Comp. Ind., 56.

Ray purple or mauve, disc orange. On open grassy slopes, on the edge of the alpine region. Tang La, 3900–4200 m., July 18, 1924. 5948. Ray mauve, disc orange. Open pastures and cultivated fields. Tumbatse, 3400 m., Aug. 5, 1924. 6055.

ERIGERON PATENTISQUAMA J. F. Jeffrey in Notes Roy. Bot. Gard. Edin. v, 185.

Disc florets yellow, ray white. On alpine grass slopes by the lake side. Nam La, 4200 m., July 25, 1924. 5998.

MICROGLOSSA ALBESCENS C. B. Clarke Comp. Ind. 59.

Ray mauve, disc yellow. On the margins of *Picea* forest. Tumbatse, 3600 m., July 3, 1924. 5897.

LEONTOPODIUM NANUM (Hook. fil. & Thoms.) Hand.-Mazt. in Beih. Bot. Centralbl. xliv, 1. 111.

Cushion plant on earth screes and grassy slopes. Not in flower. Nam La, 4500–4800 m., July 26, 1924. 6009.

ANAPHALIS ADNATA DC. Prodr. vi, 274, var. PETIOLATA Marquand & Shaw var. nov. a typo differt foliis longe (ad 3 cm.) petiolatis late oblongo-ellipticis usque 3 cm. latis.

S.E. TIBET: Flowers white. On dry gneiss cliffs by the Pasum Lake, 3000–3400 m., Aug. 8, 1924, *F. Kingdon Ward* 6110.

ANAPHALIS ROYLEANA DC. Prodr. vi, 272.

Flowers over. Bracts papery, white. In gravel and sand in the dry bed of the river. Tumbatse, 3000–3400 m., Sept. 29, 1924. 6212.

CHRYSANTHEMUM TATSIENENSE Bur. & Franch. in Morot, Journ. de Bot. v, 72. (= *C. jugorum* W. W. Smith in Notes Roy. Bot. Gard. Edin., x, 173.)

Disc and ray florets orange, the latter blood-orange on the reverse. In pastures, amongst low scrub. Atsa Tso, 4200–4500 m., Aug. 26, 1924. 6139.

Var. TANACETOPSIS W. W. Sm. sub *C. jugorum*.

On the moorland amongst dwarf *Rhododendron*. Tang La, 4200-4500 m., Aug. 17, 1924. 5944.

TANACETUM KENNEDYI Dunn in Kew Bull. 1922, 117.

On slate screes. Atsa (Pass), 4800–5100 m., Aug. 27, 1924. 6155.

TANACETUM MYRIANTHUM Franch. in Bull. Soc. Philom. Paris, sér. 8, iii, 144, var. WARDII Marquand & Shaw var. nov. a typo foliis pagina superiore griseo-viridibus adpresse subsericeo-pubescentibus distincta.

S.E. TIBET: Flowers very bright yellow, leaves strongly scented. On gravelly or sandy slopes and flats along the river-side amongst *Sophora, Jasminum, Buddleia*, etc., in the drier parts of the valley at Pe, 3000 m., Oct. 14, 1924, *F. Kingdon Ward* 6222.

ARTEMISIA BIENNIS Willd. Phyt. 11, no. 39.

Flowers over. In open pastures, particularly around Yak encampments. Atso Tso, 4200–4500 m., Aug. 26, 1924. 6140.

CREMANTHODIUM ANGUSTIFOLIUM W. W. Sm. in Notes Roy. Bot. Gard. Edin. xii, 200.

Flowers deep yellow, nodding. In glacial flats, at the foot of the moraine, in very boggy ground with fine sandy soil. Nam La, 4500 m., July 27, 1924. 6022. Also noted as abundant in high alpine pastures on the Tra La between 4200 and 4500 m. on Aug. 1, 1924.

CREMANTHODIUM BUPLEURIFOLIUM W. W. Sm. in Notes Roy. Bot. Gard. Edin. viii, 112.

Flowers yellow, nodding. In well-drained pastures where the turf is short; amongst oak scrub. Tumbatse, 3000–3400 m., July 13, 1924. 5931.

CREMANTHODIUM COMPTUM W. W. Sm. in Notes Roy. Bot. Gard. Edin. viii, 184.

Flowers very bright yellow. Under leaf surface with silvery tomentum. On screes, rising only a few inches above the surface. Nam La, 4200–4500 m., July 24, 1924. 5987.

CREMATHODIUM DECAISNEI C. B. Clarke Comp. Ind. 168.

Flowers nodding, bright yellow. On sheltered stony ledges amongst scattered dwarf *Rhododendron*, etc. Temo La, 4200–4500 m., July 7, 1924. 5905.

Flowers bright yellow, nodding. In alpine pastures and on screes. Tra La, 4500–4800 m., Aug. 2, 1924. 6042.

CREMANTHODIUM RHODOCEPHALUM Diels in Notes Bot. Gard. Edin. v, 190.

Flowers pale pinkish purple, nodding. On sheltered slopes amongst dwarf *Rhododendron*. Nam La, 4200–4500 m., July 24, 1924. 5981.

CREMANTHODIUM THOMSONI C. B. Clarke Comp. Ind. 169.

Flowers nodding, pale purplish pink. On clayey earth-banks in the *Picea* forest. Pa La (Tra La), 3400–3600 m., Sept. 26, 1924. 6201.

DORONICUM ALTAICUM Pall. in Act. Acad. Petrop. ii, 271, t. 16.

Ray and disc florets bright yellow. In damp pastures amongst *Rhododendron* scrub. Doshong La, 3400–3600 m., June 28, 1924. 5866.

SENECIO DRUKENSIS Marquand & Shaw sp. n. sectionis *Jacobaeæ*, inflorescentia stricte paniculata capitulis nutantibus foliis plerumque sublinearibus denticulatis subtus albo-tomentosis distinctissima.

Herba biennis (?). *Caulis* solitarius erectus teres, 15–30 cm. altus, primo sericeo-tomentosus dein glabrescens. *Folia radicalia* nulla. *Folia caulina* linearia usque oblanceolata obscure serrata in petiolum attenuata, usque 5 cm. longa, 4–10 mm. lata, margine sæpe revoluto, pagina superiore glabrescente, pagina inferiore dense albo-tomentosa. *Inflorescentia* terminalis angustissime secundo-paniculata, ramis erectis usque 2 cm. longis sparse tomentosis. *Bracteæ* lineares foliis superioribus consimiles, usque 3 cm. longæ. *Capitula* "pallidiuscule flava nutantia," c. 14 mm. diametro; disco c. 6 mm. diametro. *Bracteolæ* paucæ adpressæ subulatæ, 1–3 mm. longæ, apice nigræ. *Bracteæ involucrales* c. quindecim lineares acutæ,

c. 5 mm. longæ, parcissime pubescentes, apice nigro margine plerumque scarioso. *Flosculi radiales* ♀, 9–10 mm. longi, limbo lineari-oblongo, 2–2·5 mm. lato, 3–4-nervo, apice tridentato. *Flosculi disci* clavato-tubulares, 7–8 mm. longi, segmentis deltoideis acutis recurvatis. *Antheræ* ecaudatæ, apice subacuto. *Styli* patuli vel subcircinati apice leviter dilatati. *Achænia matura* non visa.

S.E. Tibet : In gravel or sand, dry barren situations by the open river. Druk-la Gompa, 3300–3600 m., Aug. 23, 1924, *F. Kingdon Ward* 6118.

Senecio paucinervis Dunn in Journ. Linn. Soc. xxxv, 507, var. brachylepis Marquand & Shaw var. nov. a typo involucræ bracteis multo (duplo) brevioribus differt.

S.E. Tibet : Flowers cream. Growing in large clumps in dry stony soil, on open terraces. Gyamda River, near Tsela Dzong, 3000 m., Sept. 7, 1924, *F. Kingdon Ward* 6176.

Cnicus Souliei Franch. in Morot, Journ. de Bot. xi, 23.

Flowers purple. In alpine pastures. Atsa Tso, 4200 m., Aug. 26, 1924. 6135.

Saussurea gossipiphora D. Don in Mem. Wern. Soc. iii, 414.

On screes. Flowers scarcely open. Nam La, 4500–4800 m., July 26, 1924. 6010. In fruit. On boulder screes. Tang La, 4500 m., Sept. 20, 1924. 6197.

Saussurea graminifolia Wall. ex Hook. fil. Fl. Brit. Ind. iii, 370.

Flowers purple. On granite and slate cliffs. Atsa Tso, 4200–4500 m., Aug. 26, 1924. 6138.

Saussurea obvallata Wall. ex C. B. Clarke Comp. Ind. 223.

On boulder screes. Tang La, 4200–4500 m., Sept. 20, 1924. 6196. Flowers over. The inflorescence is enclosed in pale yellow papery bracts and is never exposed.

Saussurea Rohmooana Marquand & Shaw sp. n. affinis *S. Atkinsoni* C. B. Clarke sed foliis minoribus subtus dense cinereo-tomentellis dentibus minoribus crebrioribus inter alia differt.

Herba perennis acaulis. *Caudex* crassus lignosus apicem versus foliorum basium persistentium reliquiis nigrescentibus vestitus. *Folia* duodecim usque viginti, rosulata patentia petiolata : lamina ovata elliptico-oblonga vel obovata subacuta subincondite fimbriato-dentata subcoriacea superne glabra inferne dense cinereo-tomentella, usque 5 cm. longa, 2 cm. lata; petiolo c. 4 cm. longo complanato dimidio inferiore foliorum basibus veteris celato. *Caulis* ut videtur nullus sed re vera foliorum basibus veteris celatus,

c. 2·5 cm. longus, lignosus. *Capitulum* solitarium terminale ut videtur sessile eis *S. Atkinsoni* aliquanto majus, c. 2·5–3·0 cm. diametro. *Receptaculum* 1·5 cm. diametro lignosum subconvexum dense setosum paleis etiam paucis sparsis præditum; setis simplicibus, c. 3 mm. longis, aureo-flavis; paleis c. 2·5 mm. longis, 0·5 m. latis, truncatis brunneis. *Bracteæ involucrales* numerosæ subscariosæ ovato-lanceolatæ acuminatæ acutæ integræ glabræ, 2–2·5 cm. longæ, 2–5 mm. latæ, margine nigro apicem versus minute ciliato-pubescente. *Flosculi* numerosissimi purpurei. *Corolla* 2·8–3·0 cm. longa, segmentibus linearibus, c. 5 mm. longis, apice leviter incrassatis. *Stamina* c. 3·1 cm. longa: antheris manifeste cærulescentibus vel cinereo-cæruleis, c. 7 mm. longis, apice acuto, basi piloso-fimbriata. *Styli* c. 3·3 cm. longi, complanati angustissime lineares divaricati. *Pappus* duplex: serie externa brevi deorsum (receptaculum versus) reflexa, c. 3 mm. longa, brevissime plumosa vel subsimplici; serie interna longa, plumosa, 1·5–1·7 cm. longa, erecta. *Ovarium* compressum, c. 3 mm. longum. *Achænia matura* non visa.

S.E. TIBET: Growing in pastures. Atso Tso, 4200–4500 m., Aug. 26 1924, *F. Kingdon Ward* 6137 (type).

The following specimens also belong to this species:—

TSARONG, S.E. TIBET: Plant of 1 inch. Flowers deep lake-purple. Open stony pasture on Ka-gwr-pw, Mekong-Salwin divide. Lat. 28° 30′ N. Alt. 13,000 ft. [3900 m.], Aug. 1917, *G. Forrest* 14529.

E. HIMALAYA (?Sikkim): Chumegata, 4500 m.. 1912 *Rohmoo Lepcha.* 323.

SAUSSUREA GNAPHALODES (DC.) Ostenf. in Sven. Hedin, S. Tibet, vi, 3, 33. (=*Aplotaxis sorocephala* Schrenck in Fisch. & Mey. En. Pl. Nov., i, 43.)

Flowers over, purple (?). Wool of the inflorescence bright purple. On slate screes, reaching higher altitudes than No. 6153 *Saussurea tridactyla* Schultz Bip. Atsa Pass, 4800–5100 m., Aug. 27, 1924. 6154. "In flower on the Tro Pass, 1700 ft. [c. 5100 m.], where it reaches as high as flowering plants occur, Aug. 31, 1924."

SAUSSUREA TRIDACTYLA Schultz Bip. ex Hook. fil. Fl. Brit. Ind. iii, 377.

Flowers purple, more or less over. On slate screes. Atsa Pass above monastery, 4800–5100 m., Aug. 27, 1924. 6153.

CAVEA TANGUENSIS (J. R. Drumm.) W. W. Sm. & Small in Trans. Bot. Soc. Edin., xxvii, 120.

Flowers white. In alpine pastures, amongst dwarf *Rhododendron.* Nam La, 4200 m., July 23, 1924. 5977.

CREPIS DEPRESSA Hook. fil. & Thoms. ex C. B. Clarke Comp. Ind. 255.

Flowers pale yellow. On alpine turf slopes facing south. Tang La, 4000 m., Sept. 20, 1924. 6192.

CREPIS DUBYÆA (C. B. Clarke) Marquand & Shaw comb. nov. [= *Lactuca Dubyæa* C. B. Clarke et *C. bhotanica* Hutchinson.]

Flowers nodding, pale yellow. In alpine pastures and in the subalpine region on loamy banks, under bushes amongst grasses and herbs. Temo La, 4200 m., Sept. 15, 1924. 6188.

CREPIS GLOMERATA Decne. in Jacq. Voy. Bot. 99, t. 107.

On the moorland amongst dwarf *Rhododendron*. Tang La, 4200–4500 m., July 18, 1924. 5946.

Var. PORPHYREA Marquand & Shaw var. nov. a typo differt floribus purpureis foliis ovatis longe petiolatis regulariter sinuato-dentatis.

Florets light purple, few and large. Leaves purplish red.

S.E. TIBET: On bare stony chutes and screes on the sunny side above the Pasum Lake, 3400–3600 m., Aug. 19, 1924. 6113. "Abundant on slate screes at 4800–5100 m., above Atsa, Aug. 27, 1924."

CREPIS RAPUNCULOIDES Dunn in Journ. Linn. Soc. xxxv, 512.

Flowers pale sulphur-yellow, nodding. In thick beds of moss in the *Picea* forest. Pa La (Tra La), 3400–3600 m., Sept. 26, 1924. 6203.

CREPIS UMBRELLA Franch. in Morot, Journ. de Bot. ix, 255.

Pa La (Tra La), 3400 m., Sept. 26, 1924. With 6202.

PRENANTHES BRUNONIANA Wall. ex DC. Prodr. vii, 195.

Flowers purple. In mossy beds in the *Picea* forest. Pa La (Tra La), 3400–3600 m., Sept. 26, 1924. 6204.

LACTUA SOULIEI Franch. in Morot, Journ. de Bot. ix, 257.

Flowers violet. On open earth slopes in the upper *Rhododendron* forest. Nyima La, 4000 m., Oct. 13, 1924. 6218.

CODONOPSIS CONVOLVULACEA Kurz in Journ. Bot. xi, 195.

Flowers violet. In thickets in the open. Gorge of the Tsang-po, near Gyala, 2700 m., July 19, 1924. 5958.

CODONOPSIS CORDIFOLIA Kom. in Act. Hort. Petrop. xxix, 108 (ex descr.).

In fruit. Twiner in thickets on the edge of the forest. Capsule purple. Tsang-po Gorge, at Gompo Ne, 1500–1800 m., Dec. 9, 1924. 6371.

CODONOPSIS FŒTENS Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 16.

Flowers lavender-purple with a network of darker purple veins. On the open moorland, among dwarf *Rhododendron*. Tang La, 4200–4500 m. July 17, 1924. 5943.

CODONOPSIS LANCEOLATA (S. & Z.) Trautv. in Act. Hort. Petrop. vi, 46.

Twiner. Flowers green outside, cream within, veined purple. In thickets and hedges and in open pastures on the edge of the forest. Tsang-po Valley, below Pe, 2700–3000 m., July 28, 1924. 6030.

CODONOPSIS OVATA Benth. in Royle Illustr. Bot. Himal. 253, t. 69, fig. 3.

Flowers lavender, veined with purple. In alpine pastures, among bushes. Nambu La, 4200–4500 m., Aug. 15, 1924. 6097.

CODONOPSIS THALICTRIFOLIA Wall. in Roxb. Fl. Ind., ed. Carey, ii, 106.

Flowers lavender with a purple ring at the base. On steep rocky *Rhododendron*-clad slopes (ancient moraines) above the glacier lake. Nam La, 4200 m., July 25, 1924. 5995.

CODONOPSIS VIRIDIS Wall. in Roxb. Fl. Ind., ed. Carey, ii, 103, var. HIRSUTA Chipp in Journ. Linn. Soc. xxxviii, 386.

Twiner. Flowers cream with a dirty violet flush. In open fields, hedges, etc. Pasum Lake, 3000–3400 m., Aug. 17, 1924. 6102.

CYANANTHUS INFLATUS Hook. fil. & Thoms. in Journ. Linn. Soc. ii, 21.

Flowers deep violet. Growing in masses under bushes by streams, in thickets, etc. Tumbatse, 3000–3400 m., Sept. 28. 1924. 6209. "In the open, in sandy soil, it forms prostrate mats."

CYANANTHUS LOBATUS Wall. ex Benth. apud Royle Ill. Bot. Himal. 309, t. 69, fig. 1.

Flowers deep violet. In sheltered situations on open pasture slopes, amongst trees. Tang La, 3400–4000 m., Aug. 18, 1924. 5949. Also noted as abundant in the cultivated fields around Tumbatse.

CYANANTHUS MACROCALYX Franch. in Morot, Journ. de Bot. i, 279, var. FLAVO-PURPUREUS Marquand in Kew Bull. 1924, 252.

Flowers pale sulphur-yellow. On open grassy slopes, amongst dwarf *Rhododendron*. Tang La, 4200–4500 m , July 18, 1924. 5947.

CYANANTHUS ? PETIOLATUS Franch. in Bull. Soc. Phil. Paris, sér. 8, iii, 147 (e descr.).

Flowers bright blue. (Calyx glabrous in 1 specimen, pubescent in others.) On sheltered banks and grassy slopes in the open and abundant in the

alpine pastures everywhere. Nambu La near Lo, 3400–4200 m., Aug. 16, 1924. 6100.

CYANANTHUS WARDII Marquand sp. n. ex affinitate *C. macrocalycis* Franch. var. *pilosi* Marquand sed foliis ellipticis sessilibus dense et longe pilosis hypophyllis magnis subscariosis inter alia differt.

Planta perennis. *Caudex* ramosus hypophyllis obtusis spathulatis submembranaceis 10–15 mm. longis 3–3·5 mm. latis dense vestitus. *Caules* floriferi et steriles multi graciles adscendentes sparse pilosi c. 8 cm. longi. *Folia caulina* infra minuta sursum increscentia oblanceolata subobtusa, usque 11 mm. longa, 4 mm. lata, subsessilia, utraque pagina dense pilosa pilis albis. *Flores* solitarii terminales brevissime pedicellati. *Calyx* externe totus densissime pilosus; tubo c. 7 mm. longo, 6–7 mm. diametro, intus glabro; lobis 5, 4–5 mm. longis, basi 3·5–4·0 mm. latis, apice subacutis, intus pilosis. *Corolla* cærulea, 3–4 cm. longa usque ad tertiam partem in lobos 5 divisa oblongos mucronulatos c. 5 mm. latos, fauce albido-tomentosa. *Stamina* 5, filamentis gracillimis corollæ tubo dimidio brevioribus. *Stylus* glaber corollæ tubum vix excedens. *Ovarium* ovato-oblongum c. 1 cm. longum glabrum.

S.E. TIBET: Nambu La, 3400–3600 m., Aug. 13, 1924, *F. Kingdon Ward.* With 6082 (*Microula sikkimensis* Hemsl.).

CAMPANULA ARISTATA Wall. in Roxb. Fl. Ind., ed. Carey, ii, 98, var. LONGISEPALA Marquand var. nov. a typo differt calycis dentibus ad 25 cm. longis.

The forms of this species vary much in the length of the calyx segments; nevertheless, since in the present plant they greatly exceed any of those in the large series in Herb. Kew., both from the Himalaya and Western China, it may be useful to distinguish it as a variety.

S.E. TIBET: Flowers violet. In pastures, Pa-sum-kye La, 4500 m., Aug. 25, 1924 (*F. Kingdon Ward*). 6133.

CAMPANULA PASUMENSIS Marquand sp. n. ex affinitate *C. coloratæ* Wall. sed calycis lobis brevioribus foliis infra tomentosis differt.

Herba perennis. *Caudex* crassiusculus. *Caules* multi adscendentes graciles pubescentes, 20–25 cm. longi, caulium annotinorum basibus persistentibus. *Folia* elliptico-rhomboidea sessilia, 4–18 mm. longa, 6–7 mm. lata, margine obscure serrato leviter recurvo, pagina superiore pubescente inferiore tomentoso, nervibus obscuris. *Bracteæ* foliis similes tantum 5–9 mm. longæ. *Pedicelli* graciles pubescentes 1–2 cm. longi. *Flores* subcernui. *Calyx* tomentosus, lobis 5 ovato-lanceolatis acutis, 4 mm. longis. *Corolla* campanulata pallide purpurea extra puberula; tubo 8–10 mm. longo, fauce 8–10 mm. lata, lobis subobtusis tubo brevioribus. *Stamina* corolla dimidio breviora. *Stylus* fere 1 mm. diametro, corollam excedens. *Fructus* non visus.

S.E. TIBET : On dry gneiss cliffs, facing south near Pasum Lake, 3000 m., Aug. 18, 1924, *F. Kingdon Ward* 6109.

ADENOPHORA LEPTOSEPALA Diels in Notes Roy. Bot. Gard. Edin. v, 175.

Flowers violet, pale blue or white. Plant of 30–60 cm. along the grassy margins of cultivated fields, with many other flowers. Tumbatse, 3400 m., Aug. 5, 1924. 6052.

AGAPETES PRÆCLARA Marquand sp. n. *A. Lacei* Craib affinis sed foliorum nervis supra conspicuis filamentisque brevissimis signe differt.

Planta epiphytica. *Caules* penduli parum ramosi pilis rigidis patulis obscure rubro-brunneis ubique vestiti. *Folia* alterna elliptico-ovata, 1·5 cm. longa, 1 cm. lata, brevissime petiolata crassa coriacea, pagina superiore bullata costa nervisque lateralibus conspicue impressis, pagina inferiore glabra pallide viridi nervis inconspicuis. *Flores* sanguinei axillares solitarii vel bini. *Pedicelli* c. 1 cm. longi glabri plus minusve rubelli. *Receptaculum* glabrum. *Calyx* c. 4 mm. longus lobis quinque triangularibus acutis 1·5–2·0 mm. longis latisque, nervis subconspicuis. *Corollæ* tubo subcylindrico fauce constricto, in hujus speciminis floribus maturissimis (vix expansis) minus quam 2 cm. longo, 4 mm. diametro, lobis acutis. *Staminum* filamenta brevissima vix ultra 0·5 mm. longa ; antheris 3·5 mm. longis apice in tubum membranaceum corollam subæquantem connatis. *Stylus* gracilis c. 2 cm. longus. *Fructus* non visus.

S.E. TIBET : Hanging from rocks and trees in the rain forest. Flowers just opening. Tsang-po Gorge, 2100 m., Nov. 28, 1924 (*F. Kingdon Ward*). 6323.

This fine species is easily distinguished from *A. Lacei* Craib, which it closely resembles, by the anthers being placed at the base of the corolla instead of at a level slightly above its middle, owing to the comparatively long filaments and shorter tubular appendage of that species, and also in the appearance of the nerves on the upper surface of the leaf.

VACCINIUM SERRATUM Wight in Calc. Journ. Nat. Hist. viii, 171, var. LEUCOBOTRYS (Nutt. ex Hook. fil.) C. B. Clarke in Hook. fil. & Thoms. Fl. Brit. Ind. iii, 452.

Flowers cream. On north-facing cliffs of the Tsang-po Gorge, 2500 m., Nov. 28, 1924. 6322.

? VACCINIUM SIKKIMENSE C. B. Clarke in Hook. fil. Fl. Brit. Ind. iii, 451. (Without flowers or fruit.)

Flowers pink (June). Fruit purplish black, excellent eating (October). On open sheltered slopes and flats amongst dwarf and scrub *Rhododendron*. Doshong La, 3300–3600 m., Oct. 17, 1924. 6227.

GAULTHERIA WARDII Marquand & Shaw sp. n. habitu ad *G. Veitchianam* Craib accedens sed calyce immutato persistente inter omnes species asiaticas distinctissima.

Frutex statura ignota. *Rami* dense adpresse villosi pilis primo sericeis aureo-brunneis serius nigrescentibus. *Folia* elliptico-lanceolata subsessilia coriacea, 3–6·5 cm. longa, 0·8–2·3 cm. lata, apice subacuminato acuto deflexo, margine anguste revoluto apicem versus cuspides paucissimas breves obtusas gerente; pagina superiore glabra nervis alte impressis; pagina inferiore dense adpresso-villosa nervis prominentibus. *Inflorescentiæ* axillares brevissime racemosæ dense brunneo-villosæ. *Bracteæ* obovatæ lanceolatæ acutæ tomentellæ, usque 5 mm. longæ. *Calyx* quinquefidus plus minusve minute tomentellus extra etiam brunneo-villosus: sepalis imbricatis oblongo-ovatis vel oblongo-lanceolatis acutis, c. 4 mm. longis. *Corolla* alba urceolata calycem leviter excedens, lobis quinque brevissimis obtusis recurvis. *Stamina* plerumque decem: filamentis glabris supra basin dilatatis corollæ dimidiam partem subæquantibus; antheris apice in caudas duas bifidas reflexas productis, foraminibus majusculis oblongis. *Ovarium* subglosum obscure pentagonum pubescens. *Stylus* simplex. *Fructus* maturus calyce nonsucculento subindurato, c. 4 mm. longo, superatus. *Semina* nigra irregulariter elongata adscendentia.

S.E. TIBET: On dry pine-clad slopes, amongst bracken etc. with *Rhododendron* and "Martagon" Lily. Tong-kyuk, 2700 m., Aug. 10, 1924, *F. Kingdon Ward* 6071.

This p'ant is anomalous among the Asiatic species of the genus in the calyx not becoming succulent as the fruit matures. It is more villose than *G. Veitchiana* Craib which it otherwise somewhat resembles.

GAULTHERIA NUMMULARIOIDES D. Don Prod. Fl. Nep. 150.

Flowers cream, berries blue-black. On banks, trailing over ledges, in pine forest. Chomo Dzong, 3000 m., Sept. 8, 1924. 6178.

GAULTHERIA FORRESTII Diels in Notes Roy. Bot. Gard. Edin. v, 210.

Flowers white. Growing in thickets in the Tsang-po Gorge, 2000–2300 m., Nov. 29, 1924. 6327.

GAULTHERIA VEITCHIANA Craib in Gard. Chron. ser. 3, lii, 188.

Flowers small, white. Berries numerous in compact clusters, almost milk-white, but with a faint bluish tinge. In thickets on open sunny screes. Po-Tsang-po, above Gompo Ne, 1800–2000 m., Dec. 23, 1924. 6396.

GAULTHERIA sp. n.? (Material insufficient for diagnosis in the absence of flowers.)

"Undershrub of 15–20 cm. growing in clumps along the open ridge in thick *Abies-Rhododendron* forest. Berries pendent bright blue." Tsang-po Gorge, 3000–3400 m., Dec. 1, 1924. 6331.

CASSIOPE SELAGINOIDES Hook. f. & Thoms. in Hook. Kew Journ. vii, 126, t. 4.

Flowers pure white, nodding, cream in bud. On grassy banks of the stream under *Rhododendron* bushes on the shady slopes. Tsela Dzong, 3000–3400 m. First collected on May 12, and later in full bloom on May 23, 1924. 5663. In clumps on gravel banks and cliffs and open earth slopes. Doshong La (Pemako), 3400–3600 m., Oct. 23, 1924. 6244.

CASSIOPE WARDII Marquand sp. n. ex affinitate *C. fastigiatæ* D. Don et *C. pectinatæ* Stapf sed foliorum pilis albis longis differt.

Suffrutex 15–20 cm. altus densiuscule ramosus. *Folia* dense imbricata vetustiora rubro-brunnea, 5–7 mm. longa, 1·5 mm. lata, oblonga, apice cymbiformi, utrinque glabra, marginibus ciliatis pilis albis sericeis usque 2·5 cm. longis ad apicem ramorum manifestioribus. *Flores* axillares solitarii penduli. *Pedicelli* tomentosi raro ultra 1 cm. longi. *Sepala* 5 rubra ovata subobtusa 3–3·5 mm. longa, margine anguste scarioso. *Corolla* ochroleuca oblongo-campanulata quinqueloba, c. 7 mm. longa, fauce 6 mm. lata. *Stamina* 8: filamentis purpureis arcuatis conniventibus sparsissimo pubescentibus; antheris ovoideis. *Ovarium* quinqueloculare. *Fructus* non visus.

S.E. TIBET: On steep grassy and rock-strewn alpine slopes and ridges, exposed to sun and wind, not yet in flower on the Temo La, 4200–4500 m., June 7, 1924. In flower on the Nyima La, June 20, 1924 (sent under same field number), *F. Kingdon Ward* 5752.

PIERIS FORMOSA D. Don in Edin. N. Phil. Journ. xvii, 159.

In bud. Flowers white? In bamboo-conifer forest in the Tsang-po Gorge, below Gyala, 2700–3000 m., Nov. 16, 1924, *F. Kingdon Ward* 6271. Flowers white. Thickets on very steep, dry, rocky slopes clothed chiefly with long grass, oak, and *Rhododendron arboreum*. E. BHUTAN: Twenty miles south of Trashigang, 1800–2000 m., Feb. 18, 1925. 6426.

PIERIS OVALIFOLIA D. Don in Edin. N. Phil. Journ. xvii, 159.

Flowers snow-white. In pine forest, on the sheltered side of the hill Pe (Tsang-po), 2700–3000 m., June 23, 1924. 5833. In thickets and open forest in the Tsang-po Gorge, Gompo Ne, 1500–1800 m., Dec. 9, 1924. 6373.

PIERIS sp. n.? (Material insufficient for diagnosis in the absence of flowers.)

Small shrub of 2–3 m. on cliffs in the rain forest. Tsang-po Gorge, 2600 m., Nov. 27, 1924. 6317.

ENKIANTHUS DEFLEXUS (Griff.) Schneid. Ill. Handb. Laubholzk. ii, 520.

In fruit. Open thickets of *Rhodendron* etc. above the rain forest. Pemako, 2700–3000 m., Oct. 24, 1924. 6254.

DIPLARCHE MULTIFLORA Hook. f. & Thoms. in Hook. Kew Journ. vi, 383.

In fruit. Forming mats on grassy alpine slopes between the clumps of dwarf *Rhododendron*. Temo La, 4200–4500 m., June 11, 1924. 5770. Also noted as in flower in the above locality on July 7.

PYROLA FORRESTIANA H. Andres in Notes Roy. Bot. Gard. Edin. viii, 8.

Flowers cream, fragrant. On steep shady banks in mixed forest. Doshong La, 2700–3000 m., June 30, 1924. 5884.

PYROLA MINOR Linn. Sp. Pl. 396.

Flowers scarcely open, white or cream? In thick masses in the bog, under dwarf *Rhododendron*. Doshong La, 3000–3400 m., June 30, 1924. 5883.

DIAPENSIA HIMALAICA Hook. f. & Thoms. in Hook. Kew Journ. ix, 373.

Flowers deep rose. Forming extensive mats on the alpine pastures between clumps of dwarf *Rhododendron*. Temo La, 4200–4500 m., June 11, 1924. 5769. Flowers salmony pink with yellow corona. On rocks and steep slopes, amongst dwarf *Rhododendron*. Doshong La, 3600–3900 m., June 24, 1924. 5840. A form with sulphur-yellow flowers growing with the above. On rocks and steep alpine slopes, when it forms large mats. Doshong La, 3600–3900 m., June 24, 1924. 5841.

DIAPENSIA WARDII W. E. Evans in Notes Roy. Bot. Gard. Edin. xv, 233.

S.E. TIBET : " Doshong La, 3000–3400 m. Not seen in flower. Prostrate creeping plant forming flat mats on the mossy and shrub-clad gneiss cliffs which face north. Growing with *Cassiope* etc. The capsule resembles that of *Diapensia himalaica*, but is borne erect on a red pedicel 2–3 inches high. Capsule turns from red to black as it ripens." In fruit, October 1924. 6226. Very distinct from all other known species in the relatively large size of the leaves.

CERATOSTIGMA MINUS Stapf ex Prain in Journ. Bot. xliv, 6.

Flowers bright blue, calyx crimson. Forming compact tufts 30–45 cm. high, and as much through, on the dry south-facing rocky slopes in gritty or gravelly soil. Tsela Dzong, 2700–3000 m., Sept. 11, 1924. 6181.

ANDROSACE ADENOCEPHALA Hand.-Mzt. in Notes Roy. Bot. Gard. Edin. xv, 295.

Flowers rose, or pale pink with greenish yellow eye; sometimes pure white. Forms small clumps on steep alpine turfy slopes, facing south. Rong-chu, Tumbatse, 4200 m., June 18, 1924. 5800.

ANDROSACE BISULCA Bur. & Franch. in Morot, Journ. de Bot. v, 103.

Flowers rose with crimson eye. At low altitudes forming close mats on open grassy slopes on the sunny side. At higher altitudes forming cushions on the cliffs. Tsang-po Valley, 3000–4000 m., May 8, 1924. 5654.

ANDROSACE ERECTA Maxim. in Bull. Acad. Pétersb. xxvii, 499.

Flowers white or pale pink. Amongst cultivated fields. Tsang-po Valley, below Pe, 3000 m., July 28, 1924. 6029.

ANDROSACE GERANIIFOLIA Watt in Journ. Linn. Soc. xx, 17.

Flowers white or flushed with pale pink. In damp shady situations under bushes on the cliffs above the river. Gorge of the Tsang-po at Gyala, 2700 m., July 21, 1924. 5966.

ANDROSACE STRIGILLOSA Franch. in Bull. Soc. bot. France, xxxii, 10, var. **CANESCENS** Marquand var. n. a typo differt foliis pilis albis longis etiam densius obsitis.

S.E. TIBET: Flowers pale pink, buds ruby; just opening. In clumps on dry scrub-clad slopes, on the sheltered flank of the mountain. Tsela Dzong, 3000 m., May 31,1924, *F. Kingdon Ward* 5726.

ANDROSACE MOLLIS Hand.-Mzt. in Sitzungs. Akad. Wiss. Wien, 1924, 136.

Flowers deep rose with yellow eye. Forming mats amongst the clumps of dwarf *Rhododendron* in alpine pastures. Temo La, 4200 m., June 11, 1924. 5768.

MÆSA sp. n. (Material too young for diagnosis.)

Flowers white. Shrub of 3–4 m. in thickets and on the margin of forest. Payi, Tsang-po Gorge, 2100 m., Dec. 2, 1924. 6338.

MYRSINE SEMISERRATA Wall. in Roxb. Fl. Ind., ed. Carey, ii, 293, var. **SUBSPINOSA** (Don) C. B. Clarke in Hook. fil. Fl. Brit. Ind. iii, 512.

Shrub of 1–1·5 m. Berries purple. In forest in the Tsang-po Gorge at Gompo Ne, 1500–1800 m., Dec. 12, 1924. 6349. "The berries are used as a medicine in Tibet under the name of *Chechongkara*" (*F. K. W.*).

ARDISIA UNDULATA C. B. Clarke in Hook. fil. Fl. Brit. Ind. iii, 524.

Undershrub of 30–45 cm. Berries carmine or scarlet. In forest. Tsang-po Gorge, at Gompo Ne, 1500–1800 m., Dec. 5, 1924. 6348. Specimen without berries or flowers.

CYNANCHUM AURICULATUM Royle ex Wight Contrib. Bot. Ind. 58.

Flowers white. A twiner sprawling over and smothering bushes in thickets on the exposed flank of the Gorge of the Tsang-po, near Gyala, 2400–3000 m., July 19, 1924. 5960.

MARSDENIA sp. n.? aff. *M. lucida* Edgew. (Specimen without flowers.)

Large twiner many feet in length with large pendent fruits in pairs. These fruits are as much as 20 cm. in length. In thin woods by the Po-Tsang-po, above Gompo Ne, 1800–2000 m., Dec. 23, 1924. 6398.

BUDDLEIA ASIATICA Lour. Fl. Cochinch. 72.

Flowers small, white, in short spikes. In thickets on the open hillsides, below the pine forest. E. Bhutan, 26° 30′ N., 91° 30′ E., 1200–1500 m., Feb. 19, 1925. 6431.

BUDDLEIA CANDIDA Dunn in Kew Bull. 1920, 134.

On cliffs and rocks in open sunny places in the river-bed and up the bracken- and grass-slopes above. Tsang-po Gorge (Gompo Ne), 1500 m., Dec. 9, 1924. 6372.

BUDDLEIA TIBETICA W. W. Sm. in Rec. Bot. Surv. Ind. iv, 270, (*B. Whitei* Kränzlin in Engl. Jahrb. l, Beibl. iii, 46), var. GRANDIFLORA Marquand var. n. a typo floribus majoribus corolla ad 12–14 mm. longa 1·5 mm. lata ramulis subteretibus differt.

S.E. TIBET: Small scraggy tree or large untidy bush up to 4–6 m. high. Flowers bright purple with deep orange eye, fragrant. No leaves yet appearing. Tsang-po Valley, below Tsetang, 3000–3400 m., April 29, 1924. 5635. Flowers lilac, purple, or almost white with orange eye. Leaves variable, covered with silver or golden fur. The plant varies very much in size and habit, from scrubby thick bushes of no more than 20–30 cm. high on the open rocky sun-scorched face of the mountain, to a large thick bush in villages and by streams in more sheltered situations. Many plants are still leafless and in flower; others are passing over and coming into leaf. Tsela Dzong, 2700–3000 m., May 22, 1924. 5693.

BUDDLEIA TSETANGENSIS Marquand sp. n. *B. alternifoliæ* Mazim. affinis sed foliis junioribus lanceolatis crassis sinuato-dentatis superne dense stellato-tomentosis inter alia recedit.

Arbuscula magna nodoso-tortuosa spissa trunco distincto usque 5–6 m. alta, vel in clivis alveisve glareosis crescens frutex vel suffrutex spissus. *Rami* annotini paniculos florum numerosos breves densos gerentes, foliis junioribus infra editis. *Folia alterna*; *juniora* lanceolata vix 2 cm. longa utrinque tomentosa; *matura* non visa. *Inflorescentia* bracteas parvas obtusas tomentosas inter floribus gerens. *Flores* fragrantes crebri subsessiles. *Calycis* tubus

2·5–3·0 mm. longus extra tomentosus intus glaber, lobis triangularibus acutis 0·5–0·7 mm. longis. *Corolla* subglabra 8–9 mm. longa, tubo 1·5–2·0 mm. lato; limbo ochroleuco, tubo intus aurantiaco florem quasi chrysoblepharum efficiente. *Antheræ* supra ipsum dimidium tubi corollini insertæ. *Stylus* brevis. *Ovarium* 2 mm. longum in stylum breviorem sensim angustatum, glabrum, longitudinaliter striatum. *Fructus* non visus.

S.E. TIBET: Abundant in most villages, around Tsetang, in the Tsang-po Valley, 3600 m. Growing in dry rocky or stony places on walls, cliffs, etc.; in full bloom April 21, 1924, *F. Kingdon Ward* 5616.

BUDDLEIA WARDII Marquand sp. n. habitu *B. tsetangensi* Marquand affinis sed ovario hispido subgloboso corolla minore subtomentosa foliis interdum oppositis inter alia differt.

Arbor parva incompta (vel *frutex* magnus ramulosus) usque 4–5 m. alta. *Rami* juniores sparse tomentosi. *Folia* opposita vel alterna; *juniora* vix 3 cm. longa lanceolata irregulariter crenato-serrata apicem versus subintegra utrinque tomentosa; *matura* non visa. *Flores* fragrantes numerosi in inflorescentiis multis subglobosis 1·5–2·0 cm. diametro congesti, in ramulis brevibus nudis vel in caulibus annotinis elongatis sessilibus. *Bractea* parvæ lanceolato-ovatæ tomentosæ. *Calyx* dense tomentosus, tubo 2·0 mm. longo, lobis triangularibus 0·5–0·7 mm. longis. *Corolla* supra externe sparse tomentosa, 6–7 mm. longa, tubo 1·0–1·5 mm. lato, limbo pallide lilacino, tubo intus aurantiaco. *Antheræ* sub ipsum medium tubi corollini insertæ. *Stylus* ovario longior. *Ovarium* subglobosum hispidum c. 1 mm. diametro. *Fructus* non visus.

S.E. TIBET: On rocks, cliffs by the river, and around villages in the Tsang-po Valley, below Tsetang, 3000–3400 m., April 29, 1924, *F. Kingdon Ward* 5636.

CRAWFURDIA TRAILLIANA G. Forrest in Notes Roy. Bot. Gard. Edin. xvii, 76.

Flowers bright purple. Abundant and very showy on open scrub- and bracken-clad slopes. Tsang-po Gorge, near Gompo Ne, 1500–1800 m., Dec. 4, 1924. 6344.

CRAWFURDIA WARDII Marquand sp. n. (§ *Dipterospermum*) a *C. Bulleyana* G. Forrest floribus solitariis calycis lobis non foliaceis inter alia recedit.

Herba scandens. *Caules* graciles purpurei tortilissimi. *Folia* breviter petiolata ovata acuminata; lamina 4–7 cm. longa, 2–3 cm. lata, integra vel basi obscure crenulata; petiolus 2–3 mm. longus. *Flores* solitarii terminales vel interdum etiam axillares. *Pedunculus* longitudine variabilis. *Calyx* purpurascens: tubus 10–13 mm. longus in uno latere ad tertiam partem divisus; lobi 5 parvi triangulares recurvati 1·5–2·5 mm. longi, nunquam foliacei. *Corolla* purpurea, late campanulata, supra expansa;

tubus 3·5–4·0 cm. longus; lobi 5, vix 5 mm. longi, latissimi subapiculati. *Filamenta* usque medium 3 mm. latum adnata (supra libera). *Antheræ* inclusæ. *Ovarium* stipitatum. *Stylus* 7–8 mm. longus. *Stigmatibus* recurvatis 5–6 mm. longis. *Capsula* dehiscens. *Semina* discoidea alata 1·5 mm. diametro; ala simplici 1·5 mm. diametro.

S.E. TIBET: Twining amongst scrub *Rhododendron* on steep slopes. Pemako, 3000–3400 m., Oct. 21, 1924, *F. Kingdon Ward* 6234.

This handsome species can easily be distinguished from both *C. Trailliana* G. Forrest and *C. Bulleyana* G. Forrest by the much less deeply-lobed corolla. The almost entire, shortly petiolate leaves and solitary flowers will serve readily to separate it from *B. speciosa* Wall.

GENTIANA ALGIDA Pall. Fl. Ross. i, 2. 107, t. 95.

One specimen approaching the var. *Romanzowii* Ledeb. Flowers creamy white, striped with thin green bands on the outside. In alpine pastures when the ground is not boggy. Pa-sum-kye La, 4200–4500 m., Aug. 25, 1924. 6143.

GENTIANA AMŒNA C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 115, forma PALLIDA Marquand f. n.

Flowers white against the dark scree. On slate screes, forming dense mats, Atsa (Pass above monastery), 4800–5100 m., Aug. 27, 1924. 6149.

Flowers are of a curious tissue-paper-like consistency, colourless, translucent, striped with thin black-purple lines on the outside upper half, faintly blotched and speckled with pale violet on the inside lower half. Leaves slightly fleshy.

The same pale form has been previously collected with the type by the Mount Everest Expedition 1921.

GENTIANA CAPITATA Buch.-Ham. ex D. Don Prod. Fl. Nep. 126.

Flowers pale blue, sometimes almost white. On dry grass-slopes on the edge of the forest. East Bhutan, 26° 0′ N., 92° 0′ E., 1800 m., Feb. 21, 1925. 6448.

GENTIANA CRASSULOIDES Bur. & Franch. in Morot, Journ. de Bot. v, 104.

Flowers deep blue. In alpine turfy pastures amongst boulders and scrub *Rhododendron* on the Nam La, 4200 m., July 25, 1924. 6000.

GENTIANA CYANANTHIFLORA Franch. ex Hemsl. in Journ. Linn. Soc. xxvi, 126.

Flowers dusky violet. On grassy patches amongst the screes. Atsa Pass, 4800 m., Aug. 27, 1924. 6166.

GENTIANA LHASSICA Burkill in Journ. As. Soc. Beng. n.s. ii, 311.

Flowers deep violet. Rosette plant on turf banks and in alpine pastures. Pa-sum-kye La, 4200–4500 m., Aug. 25, 1924. 6129.

GENTIANA NAMLAENSIS Marquand sp. n. inter *Frigidas* ex affinitate *G. oreodoxæ* H. Sm. sed foliis anguste lineari-oblongis subacutis ramorum sterilium subrosulescentibus calycis dentibus triangularibus longe differt.

Herba perennis caulibus implicate cæspitosis latissime pulviniformis, foliis glabris ramorum sterilium numerosorum subrosulescentibus anguste lineari-oblongis subacutis 2–2·5 cm. longis 2–3·5 mm. latis, ramorum floriferum paucis lineari-lanceolatis subacutis pallide viridibus 1–1·2 cm. longis, 2–2·5 mm. latis. *Rami floriferi* brevissimi pauci erecti vix 5 mm. longi. *Flores* solitarii terminales sessiles. *Calyx* foliis superioribus inclusus tubo 7–8 mm. longo, subcampanulato, lobis quinque subinæqualibus anguste triangularibus acutis c. 6 mm. longis, 3 mm. latis. *Corolla* pallide cærulea campanulato-cylindrica 2·2–2·8 cm. longa, 7–8 mm. lata lobis quinque subdeltoideis obtusis 3–3·5 mm. longis, 3 mm. latis plicis subtruncatis quam lobis angustioribus. *Stamina* 8 mm. longa. *Ovarium* capitatum. *Stylus* 3–4 mm. longus. *Semina* immatura.

The corolla is rather pale blue with the stamens united to the corolla tube along the basal 6 mm. of the filaments, upper 8 mm. of the filaments free.

S.E. TIBET : Forming extensive mats on alpine slopes amongst creeping willows etc. on the Nam La, eastern extremity of the Himalaya, 4500 m., July 27, 1924 (*F. Kingdon Ward*). 6025.

GENTIANA PHYLLOCALYX C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 116.

Flowers very deep blue. On grassy screes, alpine turf, etc., and amongst dwarf *Rhododendron*. Plants usually scattered, sometimes clumps of half-a-dozen. Temo La, 4500–4800 m., July 7, 1924. 5907. Flowers pale blue. On alpine grassy slopes by the glacier lake, on a northern aspect. Nam La, 4200 m., July 25, 1924. 5997.

GENTIANA PROSTRATA Haenke in Jacq. Coll. ii, 66, t. 17, var. CRENULATO-TRUNCATA Marquand var. n. a typo differt corollæ plicis subtruncatis crenulatis usque 1 mm. latis foliis imbricatis margine scabris.

S.E. TIBET : Flowers bright blue. Forms little patches of brilliant colour on the turf or on earth banks. Pa-sum-kye La, Tibet, 4500–4800 m., Aug. 25, 1924 (*F. Kingdon Ward*). 6130.

Var. BILOBATA Marquand var. n. a typo differt floribus minoribus vix usque 1 cm. longis corollæ plicis ovatis apice attenuatis bilobatis.

This beautiful little plant which was found mixed in the gathering of *G. crassuloides* seems quite distinct from typical *G. prostrata*, but as some specimens from Tibet (*sine loc.*) in Herb. Kew. collected for Dr. King in 1882 are apparently intermediate, I have placed it under that polymorphic species until more material is available for study. The *stems* are very short (5–10 mm. in length) numerous, ascending from the typical rosulate base.

Basal leaves few, broad, with a well-marked hyaline margin. *Cauline leaves* ovate-spathulate, mucronate, with a hyaline margin. *Calyx tube* 4·5 mm. long, 1–2 mm. wide, teeth 5 acute. *Corolla* in the dried plant dark blue below, purplish blue above (colour not noted in the field), 5-lobed, lobes ovate, attenuate, 1½ times the length of the plicæ, which are subobtusely bilobed. *Ovary* 3–4 times as long as broad. *Style* very short.

S.E. TIBET : In alpine turfy places amongst boulders and scrub *Rhododendron.* Nam La, eastern extremity of Himalaya, 4500 m., July 25, 1924, *F. Kingdon Ward.* With 6000.

GENTIANA PULMONARIA Turcz. in Bull. Soc. Nat. Mosc. xxii, 2. 317.

Flowers pale slate-blue. In sandy soil and in open pastures. Druk-la Gompa, 3400 ft., Aug. 23, 1924. 6120.

GENTIANA SIKKIMENSIS C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 114.

Flowers washy blue. On grassy banks in the subalpine region. Temo La, 3600–3900 m., Sept. 15, 1924. 6190. ? Conifer forest, Tsang-po Gorge, below Gyala, 2700–3000 m., Nov. 16, 1924. (Original field label left blank ; particulars inferred from the two succeeding numbers.) 6269.

GENTIANA TRAILLIANA G. Forrest in Notes Roy. Bot. Gard. Edin. iv, 69, t. 12.

Flowers pale slaty blue, with white hairs in the throat. On alpine turf banks, amongst dwarf *Rhododendron.* Tang La, 4000–4300 m., Sept. 21, 1924. 6199.

GENTIANA TSARONGENSIS Balf. fil. & Forrest ex Marquand in Kew Bull. 1928, 62.

Flowers dusky violet. On alpine turf slopes in exposed situations. Tang La, 4500 m., Sept. 20, 1924. 6194.

GENTIANA TUBIFLORA Wall. ex Griseb. Gentian. 277, var. NAMLAENSIS Marquand var. n. a typo differt floribus minoribus vix usque 2 cm. longis foliis basilaribus subobtusis. Differing from the type only in the lower leaves being subobtuse and the small size of all parts. Flowers deep blue.

S.E. TIBET : On alpine turfy pastures and on gravelly slopes on the Nam La, 4200 m., July 25, 1924, *F. Kingdon Ward* 5999.—*F. Kingdon Ward* 944, collected at Atuntsu on a previous expedition, is the same variety of this species.

GENTIANA VEITCHIORUM Hemsl. in Gard. Chron. xlvi, 178.

Petals almost sky-blue, or bright china-blue, the tube more or less white inside with long stripes on the reverse. In alpine pastures near Gyamda, 4200–4500 m., Aug. 30, 1924. 6171. Flowers deep rich blue, with narrow panels or pleats of green on the reverse. On sunny earth slopes above the

Pasum Lake, 3400–3600 m., Aug. 19, 1924. 6114 (*forma*).—Also noted as abundant on alpine turf slopes around Atsa, up to 4500–4800 m. Flowers sometimes pale blue.

GENTIANA WALTONI Burkill in Journ. As. Soc. Beng. n. s. ii, 310.

Flowers pale violet-blue. On the sunny side of granite cliffs. Gyamda, 3400 m., Sept. 2, 1924. 6173. Flowers deep sea-blue, rarely pale blue, purple or magenta. On steep sunny shrub-clad gravel and sand slopes, amongst scrub oak and bushes, growing in masses, a fine sight. Pe, 3000 m., Oct. 14, 1924. 6221.

LOMATOGONIUM DELTOIDEUM Marquand comb. n.

Pleurogyne deltoidea Burkill in Journ. As. Soc. Beng. n. s. ii, 324.

Swertia deltoidea Burkill, l. c.

Flowers pale slate-blue. On dry gritty scrub-clad slopes. Tsela Dzong, 2700–3000 m., Sept. 11, 1924. 6183.

LOMATOGONIUM OREOCHARIS Marquand comb. n.

Pleurogyne oreocharis Diels in Notes Roy. Bot. Gard. Edin. v, 222.

On alpine turf slopes. Temo La, 4200–4500 m., Sept. 14, 1924. With 6185. Flowers bluish-violet. Forming small clumps on alpine turf slopes on the Temlo La, 4200–4500 m., Sept. 14, 1924. 6186.

KINGDON-WARDIA Marquand gen. n. (*Gentianaceæ-Swertieæ*).

Herba annua. *Folia* opposita. *Calyx* tubulosus 5-fidus usque medium lobatus, lobis inæqualibus. *Corolla* tubuloso-campanulata, circa ad ¼ lobata, tubo basin versus foveolis 5 glandulosis margine ciliato-fimbriatis lobis oppositis instructo. *Stamina* 5 corollæ basi affixa. *Stylus* subnullus.

A new genus occupying a somewhat intermediate position between *Gentiana* and *Swertia*, differing from the former in the presence of a fimbriate foveola towards the base of the corolla below each corolla lobe, and from the latter in the conspicuous calyx tube surmounted by triangular lobes and well-marked corolla tube. From *Jaeschkea* it is readily distinguished by the position of the stamens, which arise from the base of the corolla instead of from the sinus between the lobes.

KINGDON-WARDIA CODONOPSIDOIDES Marquand sp. n. *Swertia codonopsidoides* Burkill MS. in Herb. Kew.

Herba annua. *Caulis* erectus basi tortilis 25–35 cm. altus. *Folia basalia* nulla. *Folia caulina* opposita lanceolato-oblonga sessilia 3–4 cm. longa, 0·7–1 cm. lata subacuta. *Pedunculi* 2–3 cm. longi axillares 2–3 flores breviter pedicellatos gerentes. *Calyx* campanulatus subglaber tubo 3–4 mm. longo, lobis quinque inæqualibus triangularibus, margine sparse pilosa, duobus

magnis duobus parvis, 2·5–4·5 mm. longis, 4·6 mm. latis. *Corolla* pallide purpurea tubulato-campanulata 8–10 mm. longa circa ad quartam partem in lobos quinque divisa æquales subacutos sinubus angustis. *Foveolæ* quinque glandulosæ margine ciliato-fimbriatis. *Stamina* quinque 6–7 mm. longa. *Ovarium* stamina excedens. *Stigma* subsessile.

The flower colour is a pale dull purple. The filaments are widened towards the base where they join to form a staminal tube 1 mm. long, arising from the base of the flower.

S.E. TIBET: In colonies under juniper or *Picea* trees, on the edge of the meadow, in damp shady situations. Pa La (Tra La), 3600 m., Sept. 26, 1924, *F. Kingdon Ward* 6205 (type).

Tibet, 1882, "*Dr. King's collector*" (*Dungboo*?) in Herb. Kew. sine num.

SWERTIA HISPIDICALYX Burkill in Journ. As. Soc. Beng. n. s. ii, 321, forma SUBGLABRA Marquand f. n. a typo differt calycis pilis perpaucis.

Flowers magenta. On gravelly or sandy soil, amongst grass, etc., on open plains all up the Gyamda Valley.

S.E. TIBET: Chomo Dzong, 3000 m., Sept. 8, 1924, *F. Kingdon Ward* 6179. The calyx bears a few scattered hairs.

SWERTIA WARDII Marquand sp. n. *S. obtusæ* Ledeb. valde affinis sed floribus majoribus pedicellis longioribus recedit.

Herba perennis. *Caudex* crassus. *Caulis* erectus 30–40 cm. altus. *Folia inferiora* oblonga lamina 4–6 cm. longa breviter attenuata, petiolo lato, 2–3 cm. longo. *Folia caulina* pauca anguste oblonga vel leviter attenuata basi lata apice subobtusa. *Flores* cæsii solitarii vel bini. *Pedicelli* 2–3 cm. longi. *Sepala* lanceolato-ovata acuta 8–10 mm. longa. *Petala* oblonga acuta 15–18 mm. longa, 5–6 mm. lata. *Foveolæ glandulosæ* 10 fimbriatæ c. 0·8 mm. diametro prope corollæ basin. *Stamina* 7–8 mm. longa. *Ovarium* c. 10 mm. longum. *Stigma* sessile non decurrens. *Semina matura* non visa.

S.E. TIBET: In damp alpine pastures and meadows, flowering in September and October. Temo La, 4200–4500 m., Oct. 10, 1924, *F. Kingdon Ward* 6216.

This species resembles the Northern Asiatic *S. obtusa* Ledeb., but bears much larger flowers of a slate-grey colour, which take on when dry a distinctive metallic shade.

HALENIA ELLIPTICA D. Don in Trans. Linn. Soc. xvii, 529.

Flowers pale violet. In marshy places, where it forms large colonies. Tumbatse, 3000–3400 m., July 13, 1924. 5932.

PARACARYUM GLOCHIDIATUM (DC.) C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 161.

Flowers bright blue. On shaded banks and under trees by the river. Rong-chu (Tumbatse), 3600 m., June 15, 1924. 5782. Flowers sky-blue. Growing in massed formation in shady thickets by the stream. Rong-chu, 3600–3900 m., June 17, 1924. 5794.

MICROULA SIKKIMENSIS (Oliv.) Hemsl. in Hook. Ic. Pl. sub t. 2562.

Flowers bright cobalt-blue. Growing in large clumps on bare wet granite cliffs. Nambu La, 3400–3600 m., Aug. 13, 1924. 6082.

MICROULA TIBETICA Maxim. Mél. Biol. x, 682.

Flowers blue. On screes and gravelly banks. Atsa, 4200–4500 m., Aug. 27, 1924. 6151.

OREOGENIA MUNROI (C. B. Clarke) J. M. Johnston in Contrib. Gray Herb. n. s. lxxiii, 66.

Flowers blue. Amongst cultivated fields. Tsang-po Valley, below Pe, 3000 m., July 28, 1924. 6028. Flowers pale blue, very small and numerous. On dry oak-scrub-clad banks and in dry open pastures on gravelly soil, abundant. Pasum Lake, 3000 m., Aug. 17, 1924. 6105.

TRIGONOTIS ROTUNDIFOLIA (Wall. ex Benth.) Benth. ex C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 172.

Flowers pale sky-blue. On shady banks under rocks. Temo La, 3900 m., June 5, 1924. 5738.

ONOSMA HOOKERI C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 178.

On rocky slopes in thin oak forest on the sunny side of Pasum Lake, facing south east; also in pastures; 3000–3400 m., Aug. 19, 1924. 6115.

ONOSMA WADDELLII Duthie in Kew Bull. 1912, 41.

Flowers sky-blue. In rocky open situations by the river on very sandy soil. Gorge of the Tsang-po, at Gyala, 2700 m., July 21, 1924. 5965.

SCOPOLIA LURIDA Dunal in DC. Prod. xiii, 555.

Flowers cream, sometimes rimmed with purple, evil-smelling. Growing rankly round villages with docks, *Impatiens*, and other weeds. Chu-nyima, 3000 m., Aug. 9, 1924. 6068.

LINARIA YUNNANENSIS W. W. Sm. in Notes Roy. Bot. Gard. Edin. ix, 110.

Flowers pale purple. On open sunny grass and bracken slopes. Gorge of the Tsang-po, near Gyala, 2700 m., July 19. 1924. 5959.

Scrophularia Przewalskii Batal. in Act. Hort. Petrop. xiii, 382.

Flowers yellow. In shady crevices amongst boulders, in the forest. Nyima La, 3600–3900 m., 5820. Flowers orange. On screes and under boulders ; prostrate plant. Nam La, 4200–4500 m., July 24, 1924. 5989.

Lindenbergia grandiflora Benth. Scroph. Ind. 22.

Flowers gamboge. On rocky grass-clad slopes, where oak and *Rhododendron* grow scattered. Nyamjang Chu, Mönyul and southwards into Bhutan, 1500–2100 m., Feb. 13, 1925. 6420.

Lindenbergia Griffithii Hook. fil. Fl. Brit. Ind. iv, 262.

Flowers bright yellow, the lower lip with small purplish brown speckles. Weak weedy shrub, growing several feet high but not erect, the stems soon flopping over. In thickets. East Bhutan, 26° 30′ N., 91° 30′ E., Feb. 19, 1925. 6425.

Euphrasia Jaeschkei Wettst. Mon. Gatt. Euphr. 80, *forma* (*e descr.*).

Flowers white with a splash of egg-colour on the lower lip ; anthers dark chocolate. In pastures down in the valley. Tsela Dzong, 2900 m., May 28, 1924. 5706.

Pedicularis aschistorrhyncha Marquand & Shaw sp. n. ex affinitate *P. Scullyanæ* Prain, *P. macranthæ* Klotzsch et *P. insignis* Bonati sed a prioribus galea apice integra, a postrema calycis lobis 2 foliaceis differt.

Caulis erectus glaber, 17 cm. altus. *Folia basalia* pauca bipinnatifida, usque 12 cm. longa, longe petiolata; laminæ pagina superiore glabra, pagina inferiore minute areolata sparsissime hirsuta, pinnularum margine inciso-dentato acuto ; petiolo basi vaginante, vagina in costam sursum versus ut ala angusta producta. *Folia caulina* pauca alterna basalibus consimilia sed minora. *Inflorescentia* terminalis breviter racemosa c. 10–12-flora ; bracteis foliiformibus. *Pedicelli* glabri, usque 1 cm. longi. *Calyx* laxe hirsutus, tubo cylindrico basi truncato, apice breviter dimidiato, lobis duobus foliaceis ovatis bipinnatifidis basi constrictis, 6–8 mm. longis. *Corolla* ampla : tubo gracili; usque 2 cm. longo, in calyce incluso ; labello albo lato suborbiculari, fere 2 cm. longo latoque, lobis rotundatis lateralibus, 7–8 mm. latis, intermedio subminore basi leviter contracto ; galea subfalcata purpurea, 3–4 mm. lata, apice breviter rostrato, rostro decurvato integro obtuso vel vix truncato. *Filamenta* circa vel infra medium tubi inserta, duo hirsuta duo glabra. *Fructus* non visi.

S.E. Tibet : In marshy meadows. Tumbatse, 3400–3600 m., July 13, 1924, *F. Kingdon Ward* 5930.

PEDICULARIS BELLA Hook. fil. Fl. Brit. Ind. iv, 313, var. HOLOPHYLLA Marquand & Shaw var. n. a typo differt foliis integerrimis.

S.E. TIBET: Flowers deep crimson. On open grass slopes in the upper *Rhododendron* forest. Tang La, 3600–3900 m., July 17, 1924, *F. Kingdon Ward* 5942.

Forma ROSEA Marquand & Shaw f. nov. a varietate supra descripta floribus roseis differt.

S.E. TIBET: Flowers pink. In alpine pastures on Nam La, 4200 m., July 23, 1924, *F. Kingdon Ward* 5975.

PEDICULARIS CEPHALANTHA Franch. ex Maxim. in Bull. Acad. Pétersb. xxxii, 540.

Flowers crimson. In open spaces in the *Picea-Rhododendron* forest. Temo La, 4200 m., June 7, 1924. 5754. Amongst dwarf *Rhododendron* on the alpine moorland. Temo La, 4200–4500 m., July 7, 1924. 5904.

PEDICULARIS CHEILANTHIFOLIA Schrenk Enum. Pl. Nov. ii, 19.

Flowers pale sulphur-yellow. In pastures by the river. Druk-la Gompa, 3400 m., Aug. 22, 1924. 6116.

PEDICULARIS CRYPTANTHA Marquand & Shaw sp. n. ex affinitate *P. Œderi* Vahl sed caule florifero obsolescente corollæ tubo curvato filamentis omnibus glabris inter alia differt.

Caudex repandus robustior. *Caulium sterilium* e caudice plurium subcæspitosorum pars basalis efoliata gracilior glabrescens, 1–3 cm. longa, pars superior usque 14 cm. longa, adscendens sparse pubescens. *Folia* longe petiolata inferne lobis pinnatifidis pinnata superne bipinnatifida, usque 12 cm. longa; pagina superiore glabra vel parcissime hirsuta, pagina inferiore minute areolata; petiolo inferne dense superne sparse villosa. *Inflorescentia* solitaria inter caulium bases subsessilis, 10–12-flora. *Flores* "sulphurei, sine maculis." *Pedicelli* graciles, usque 2 cm. longi (et fortasse longiores), plus minusve hirsuti. *Calycis* tubus cylindricus, c. 4 mm. longus, 2·5 mm. diametro, dense villosus; lobis quinque anguste lanceolatis subacutis, c. 1·5 mm. longis. *Corolla* 1·8 cm. longa; tubo inferne erecto, 1·5 mm. lato, superne proflexo et subdilatato; galea erecta apice leviter incurvata tubo æquilonga, 2 mm. lata, apice subacuta; labello suborbiculari trilobo, lobo terminali orbiculari, 3 mm. diametro, basi constricto, lateralibus longitudinaliter reniformibus, c. 5 mm. longis. *Filamenta* omnia glabra. *Stylus* brevis. *Fructus* non visi.

S.E. TIBET: On the grassy banks of streams, in woods. Tsela Dzong, 3400 m., May 29, 1924, *F. Kingdon Ward* 5711.

PEDICULARIS DENSISPICA Franch. ex Maxim. in Bull. Acad. Pétersb. xxxii, 594.

Flowers pale purplish pink. On open bracken- and pasture-clad terraces above the river. Gorge of the Tsang-po, near Gyala, Tibet, 2700–3000 m., July 19, 1924. 5955.

PEDICULARIS ELWESII Hook. fil. Fl. Brit. Ind. iv, 312.

Flowers deep purple-crimson. In marshy meadows. Tumbatse, 3400–3600 m., July 3, 1924. 5929.

PEDICULARIS GRACILIS Wall. ex Benth. Scroph. Ind. 52.

In dry stony situations amongst small scrub. Tong-Kyuk, 2700–3000 m., Aug. 10, 1924. 6072.

PEDICULARIS INGENS Maxim. in Bull. Acad. Pétersb. xxxii, 565.

Flowers straw-yellow. In *Rhododendron* forest, or under *Rhododendron* scrub in the alpine region. Nam La, Tibet, 3900–4200 m., July 25, 1924. 5996.

PEDICULARIS INTEGRIFOLIA Hook. fil. Fl. Brit. Ind. iv, 308.

Flowers bright crimson. In the open moist meadows of the valley. Lunang, 3000 m., Aug. 2, 1924. 6039.

PEDICULARIS LONGIFLORA Rudolph in Mém. Acad. Pétersb. iv, 345, t. 3.

Flowers bright gamboge, with two small chocolate streaks radiating from the centre of the lower lip. In open bogs in the Tsang-po Valley, east of Tsetang, Tibet, 3000–3400 m., May 1, 1924. 5639. Flowers bright orange with two chocolate-brown streaks on the lower lip. In open bogs. Rong-Chu, Tumbatse, Tibet, 3600 m., June 15, 1924. 5786. Flowers brilliant orange with two chocolate-brown marks on the lower lip. In bogs, Tumbatse, in full bloom at 3000–3400 m., on July 10, 1924. 1924. 5926. Flowers crimson, darker in the centre ; tube hairy. On alpine turf slopes. Atsa Pass, 4800 m., Aug. 27, 1924. 6167.

PEDICULARIS MOLLIS Wall. ex Benth. Scroph. Ind. 53.

Flowers dark crimson. In meadows under rocks and bushes. Nambu La, near Lo, 3400 m., Aug. 16, 1924. 6099.

PEDICULARIS MYCHOPHILA Marquand & Shaw sp. n. ex affinitate *P. aphyllocaulis* Hand.-Mzt. sed foliis dense tomentosis pedunculis longioribus filamentis glabris differt.

Radices haud (?) fasciculati, angustissime pastinacæformes usque 9 cm. longi. *Caules* e radice c. tres, 7–8 cm. alti, erecti efoliosi puberuli. *Folia* radicalia fasciculata erecta petiolata, usque 5·5 cm. longa, lamina

petiolo subæquilonga, usque 1·3 cm. lata, lanceolata bipinnatifida utraque pagina dense et breviter tomentosa. *Inflorescentia* scaposa pauciflora. *Bracteæ* petiolatæ binæ oppositæ foliiformes pinnatifidæ utraque pagina dense tomentosæ, usque 2·5 cm. longæ. *Flores* axillares solitarii. *Pedunculi* pubescentes bracteis subbreviores. *Calyx* ellipsoideus obliquus, c. 6 mm. longus, 2·0–2·5 mm. latus, fructu jam maturo lateraliter fissus, usque 9 mm. longus, 5–6 mm. latus, dense pubescens quinquelobatus lobis brevissimis obtusis vel emarginatis. *Corolla* atro-sanguinea: tubo suberecto, c. 11 mm. longo, 1 mm. diametro, glabro; galea erecta, 6–8 mm. alta, c. 1·5 mm. lata, margine inferiore plus minusve horizontali recto superiore convexo, in rostrum decurvatum truncatum c. 5 mm. longum angustata; labello trilobo lobo medio late ovato lateralibus subreniformibus minore. *Staminum* filamenta gracilia omnia glabra; antheris ellipticis. *Fructus* (? vix maturus) ovoideus subacuminatus acutus nigrescens lævis subnitens, c. 1 cm. longus, 4–5 mm. diametro.

S.E. TIBET: In crevices and on ledges of the gneiss cliffs. Nam La, 4200–4500 m., July 25, 1924, *F. Kingdon Ward* 6043.

PEDICULARIS OEDERI Vahl in Harnem. Dansk. Oek. Plantel., ed. 2, 580.

Flowers dull straw-yellow with two brownish-purple spots on the upper lip. In pastures and on scrub-clad slopes among dwarf *Rhododendron*. Temo La, Tibet, 3900–4200 m., June 11, 1924. 5767.

PEDICULARIS PECTINATA Wall. ex Benth. Scroph. Ind. 52.

Flowers crimson. Plant of 40–60 cm. In dry pastures in the forest and also in meadows. Chu-nyima, 3000 m., Aug. 9, 1924. 6066.

PEDICULARIS RHINANTHOIDES Schrenk Enum. Pl. Nov. i, 22.

Flowers pale purplish pink; "horn" lip dark purple. In open sunny bogs. Temo La, 4300 m., June 6, 1924. 5744. Flowers pale purplish pink, the twisted "horn" dark purple. In open bogs. Temo La, 4200–4500 m., July 6, 1924. 5902. Lower lip bright sulphur-yellow, deep lemon in the centre; upper lip also deep lemon. Frequent in pastures in the valley near Nambu La, 3600 m., Aug. 16, 1924. 6098.

PEDICULARIS ROYLEI Maxim. in Bull. Acad. Pétersb. xxvii, 517.

Flowers light purple. In bogs on the steep side of the hill. Temo La, 3600–3900 m., June 8, 1924. 5763. Flowers purple. In open boggy pastures. Temo La, 4200–4500 m., July 6, 1924 5903.

Var. CINERASCENS Marquand & Shaw var. nov. a typo differt foliis cinereopubescentibus.

S.E. TIBET: Flowers purple with the upper lip darker. On alpine slopes, amongst dwarf *Rhododendron*. Nyima La, 4500 m., June 21, 1924, *F. Kingdon Ward* 5814.

PEDICULARIS SIPHONANTHA D. Don Prod. Fl. Nep. 65.

Flowers purple. On open dry grassy slopes in the *Rhododendron* forest. Nam La, Tibet, 3900 m., July 23, 1924. 5976.

PEDICULARIS SZECHUANICA Maxim. in Bull. Acad. Pétersb. xxxii, 588.

Flowers purple. In open pastures on the margins of woodland. Tumbatse, Tibet, 3600 m., July 14, 1924. 5938.

PEDICULARIS TRICHOGLOSSA Hook. fil. Fl. Brit. Ind. iv, 310.

Flowers crimson. In alpine turf pastures and amongst dwarf *Rhododendron*. Nam La, 4300 m., July 23, 1924. 5974.

PINGUICULA ALPINA Linn. Sp. Pl. 17.

Flowers white with a lemon-yellow spot on the lower lip. Along the grassy banks of the stream, shaded beneath bushes of *Rhododendron*, etc. Tsela Dzong, 3000–3400 m., May 12, 1924. 5665.

ÆSCHYNANTHUS BRACTEATA, Wall. ex DC. Prodr. ix, 261.

Erect plant of 30–45 cm., growing on fern-clad rocks in thick forest; also epiphytic. Tsang-po Gorge, at Gompo Ne, 1500–1800 m., Dec. 9, 1924. 6370.

ÆSCHYNANTHUS LEVIPES C. B. Clarke in DC. Monog. Phan. v, 28.

In fruit, hanging in festoons from the trees in the forest. Tsang-po Gorge (Gompo Ne), 1500 m., Dec. 10, 1924. 6377.

OREOCHARIS sp.? (No flowers or seeds and therefore *indet.*)

In damp moss on the shady side of the cliff, in *Rhododendon* and *Picea* forest. Lusha, 3000–3400 m., May 18, 1924. 5680.

DIDISSANDRA LANUGINOSA C. B. Clarke in Hook. fil. Fl. Brit. Ind. iv, 355.

Flowers pale violet, nearly over. On gneiss rocks, shaded side. Gyala, Gorge of the Tsang-po, 2700 m., July 29, 1924. 6047.

DIDISSANDRA RUFA King in Hook. Ic. Pl. xv, t. 1437.

Flowers bright violet. On gneiss cliffs, under oak scrub in sheltered or damp situations. Pasum Lake, 3000 m., Aug. 18, 1924. 6108.

GESNERACEÆ indet. (With no flowers or seeds.)

"Leaves like green velvet, covered with pubescent hairs." On damp moss-clad granite cliffs in the forested glen. Tsela Dzong, 3400 m., May 23, 1924. 5697.

INCARVILLEA GRANDIFLORA Bur. & Franch. in Morot, Journ. de Bot. v, 138.

In fruit on grassy banks and ledges of granite cliffs. Atsa Tso, 3900–4200 m., Aug. 26, 1924. 6145.

STROBILANTHES ALATUS Nees in DC. Prodr. xi, 194.

Flowers pale violet, brownish-yellow in the throat. Growing socially in the forest and there attaining a height of 6 or 8 feet. On sheltered slopes, in thickets, it is not so tall or bushy. E. Bhutan, 1200–1800 m., Feb. 20, 1925. 6437.

STROBILANTHES sp. n. aff. *S. capitato* T. Anders. (Material insufficient for diagnosis.)

Flowers violet. Woody plant of 2–3 m., growing in colonies in the forest in fairly open situations. Tsang-po Gorge, at Gompo Ne, 1500 m., Dec. 10, 1924. 6379.

ASYSTASIA MACROCARPA Nees in Wall. Pl. As. Rar. iii, 89.

Flowers white but tinged and striped with purple, the teeth darker purple. Undershrub of 1–2 m. in subtropical forest. E. Bhutan, 26° 30′ N., 91° 30′ E., Feb. 19, 1925. 6433.

"Like many species of *Acanthaceæ* this species shows movement of stamens. It is protandrous. In the ♂ stage, the style and stigma lie parallel to and above the two stamens, which are closely pressed against the upper lip of the corolla, the two anthers touching each other. In the ♀ stage the stamens separate, moving one to each side exposing the style, while the stigma now bends sharply down, clear of the upper lip, and projects right into the fairway. There are two conspicuous staminodes." (*F. K. Ward*).

PHLOGACANTHUS THYRSIFLORUS Nees in Wall. Pl. As. Rar. iii, 99.

Flowers dull brownish orange. Any erect bush or scrub of 2–3 m. in thickets and margins of jungle in E. Bhutan, 26° 30′ N., 91° 30′ E., 1200 m., Feb. 19, 1925. 6434.

ADHATODA VASICA Nees in Wall. Pl. As. Rar. iii, 103.

Flowers pure white. In thickets, forming a large bushy shrub 2·5–4 m. in height. East Bhutan, without precise locality, 1200 m., Feb. 22, 1925. 6447.

LAGOTIS GLAUCA J. Gaertn. in Nov. Comm. Petrop. xiv, 533, t. 18, fig. 1.

Flowers purple, practically over; calyx and bracts bright violet. On slate screes. Atsa Pass, 4800–5100 m., Aug. 27, 1924. 6160.

CARYOPTERIS WALLICHIANA Schauer in DC. Prod. xi, 625.

Flowers pale violet. A weak shrub as much as 2·5 m. high in the thickets in E. Bhutan, 26° 30′ N., 91° 30′ E., 1200–1500 m., Feb. 19, 1925. 6432.

PLECTRANTHUS ORESBIUS W. W. Sm. in Notes Roy. Bot. Gard. Edin. ix, 118.

Flowers very pale violet, almost white, the upper lip spotted darker. Leaves strongly scented. Compact undershrub of 30–60 cm. on dry scrub-clad south slopes. Tsela Dzong, 2700–3000 m., Sept. 11, 1924. 6182.

PLECTRANTHUS WARDII Marquand & Shaw sp. n. *P. Bulleyano* Diels affinis, sed foliis plerumque latioribus grossius subcrenatis longi-petiolatis petiolis gracilibus corollæ paullo majoris tubo basi gibboso recedit.

Frutex vagabundus, usque 2 m. altus. *Rami* obscure quadranguli puberuli. *Folia* longe petiolata: petiolo gracili, usque 3·5 cm. longo, exalato; lamina subrhomboidali, 3–6 cm. longa, 2·5–4·0 cm. lata, marginibus anterioribus subprofunde crenato-serratis, marginibus posterioribus integris, basi cuneata, apice acuminato usque obtuso, utraque pagina glabra. *Inflorescentia* laxiuscula foliosa; cymis inferioribus petiolos æquantibus vel vix superantibus. *Pedunculi pedicellique* graciles puberuli. *Bracteæ bracteolæque* minutæ lineares puberulæ, vix ultra 1 mm. longæ. *Flores* pallide violacei. *Calyx* subcampanulatus, c. 4 cm. longus, inæqualiter (unam partem usque duas partes longitudinis) quinquedentatus, dentibus duobus longioribus duobus subbrevioribus, quinto brevi recurvo, deltoideo-lanceolatis acutis intus pubescentibus extra minus pubescentibus; demum erectus parum ampliatus. *Corolla* majuscula, 1·0–1·2 cm. longa, pubescens supra ipsam basin abruptissime gibboso-saccata, c. 3 mm. diametro; labio superiore integro plus minusve ovato, c. 4·5 mm. diametro; labio inferiore glabrescente quadriloba̱ta, lobis suborbicularibus basi leviter contractis, c. 2 mm. diametro. *Stamina* corollam subæquantia staminibus interioribus sublongioribus. *Fructus* maturi non visi.

S.E. TIBET: Large straggling bush of 2 m. in open places in mixed forest in the Gorge of the Tsang-po, near Gyala, 2700-3000 m., July 19, 1924, *F. Kingdon Ward* 5957.

POGOSTEMON ELSHOLTZIOIDES Benth. in DC. Prod. xii, 153.

Flower purple. On open bracken- and scrub-clad sunny slopes of the Tsang-po Gorge, near Gompo Ne, Dec. 4, 1924. 6346. Flowers purple. Bushy shrub 2–2·5 m. high in thickets. East Bhutan, 26° 0′ N., 92° 0′ E., 1200 m., Feb. 22, 1925. 6449.

ELSHOLTZIA STROBILIFERA Benth. Lab. Gen. et Sp. 163.

Flowers bright yellow. Open pastures by streams in sandy soil. Leaves very strongly scented. Atsa Tso, 4200–4500 m., Aug. 26, 1924. 6141.

MICROMERIA WARDII Marquand & Shaw sp. n. *M. Piperellam* DC. aliquanto simulans sed habitu exaltata foliis petiolatis basi angustatis calycis dentibus brevioribus distinctissima.

Herba perennis, usque 50 cm. alta. *Caules* rigidi erecti teretes purpurascentes sparse albido-puberuli. *Folia basalia* nulla. *Folia caulina* ellipticoovata obtusa petiolata basi subcuneato, petiolo 3–5 mm. longo puberulo, lamina usque 15 mm. longa, 8 mm. lata, pagina superiore scaberula utraque pagina minute depresso-glandulosa. *Bracteæ* foliiformes foliis minores. *Inflorescentia* laxa e cymis subpaucifloris axillaribus constans. *Bracteolæ* minutæ subulateæ. *Pedicelli* graciles puberuli, 1–3 mm. longi. *Calyx* cylindricus purpurascens puberulus, 4–5 mm. longus, c. 1·5 mm. diametro, glandulis numerosis microscopicis sessilibus aureo-nitentibus obsitus, dentibus brevissimis deltoideis subacutis, fauce pilis longis albis prædita. *Corolla* violacea majuscula gracilis, usque 1·4 cm. longa, extra pubescens, labiore superiore ovato bilobato, c. 3 mm. diametro, labio inferiore superiore sublongiore trilobato lobis oblongis rotundatis. *Stamina* quatuor didynama, duo exteriora labio superiore subbreviora, duo interiora ad faucem tubi attingentia ; antheris reniformibus. *Stylus* filiformis, 1·1 cm. longus, apice vix bifido. *Ovarium* breviter quadrilobatum. *Nuculi* ellipsoideo-oblongi, c. 1·3 mm. longi, læves subtrigoni.

S.E. TIBET : Undershrub of bushy habit with powerfully scented leaves. On open rocky grass-clad slopes in the Tsang-po Gorge, c. 2100 m., Nov. 28, 1924, *F. Kingdon Ward* 6324.

SALVIA HIANS Royle ex Benth. in Hook. Bot. Misc. iii, 373.

Flowers blue with white lower lip. Plant of 60–70 cm. growing in alpine stony pastures, amongst shrubs. Near Gyamda, 3600 m., Sept. 1, 1924. 6172.

SALVIA PRZEWALSKII Maxim. in Bull. Acad. Pétersb. xxvii, 526.

Flowers very dark purple, with velvety sheen. Abundant in open stony pastures by streams. Tumbatse, 3400 m., Aug. 5, 1924. 6053.

SALVIA TRICUSPIS Franch. in Bull. Soc. Philom. Paris, sér. 8, iii, 150.

Flowers cream. In cornfields. Tumbatse, Tibet, 3400 m., Aug. 4, 1924. 6049.

NEPETA CŒRULESCENS Maxim. in Bull. Acad. Pétersb. xxvii, 529 (=*N. Thomsoni* Benth. ex Hook. fil. Fl. Brit. Ind. iv, 658), *forma.*

Flowers pale violet, leaves strongly scented. In sheltered gullies or under rocks in the alpine pastures. Atsa Tso, 4500 m., Aug. 26, 1924. 6136.

GLECHOMA COMPLANATA (Dunn) Turrill in Rep. Bot. Exch. Cl. Brit. Isles, v, 695.

Flowers violet. Plant strongly scented. On slate screes, rare. Atsa Pass, 4800–5200 m., Aug. 27, 1924. 6157.

Dracocephalum Hemsleyanum Prain MS. comb. nov. (=*Nepeta Hemsleyana* Oliver ex Hemsl. apud Prain in Journ. As. Soc. Beng. lix, 305).

Flowers bluish violet. Forming large clumps on open gravel terraces above the river. Gyamda, 3400 m., Sept. 2, 1924. 2174.

Dracocephalum tanguticum Maxim. in Bull. Acad. Pétersb. xxvii, 530.

Flowers bright violet. On granite and slate cliffs, sheltered in clefts. Atso Tso, 4200–4500 m., Aug. 26, 1924. 6134..

Galeopsis Tetrahit Linn. Sp. Pl. 579.

Flowers creamy yellow, lower lip violet. In cornfields. Tumbatse, 3400 m., Aug. 4, 1924. 6048.

Phlomis tibetica Marquand & Shaw sp. n. *P. bracteosæ* Royle ex Benth. affinis sed bracteolis omnibus angustissimis spinosis cum calyce et labio superiore intus pilis nigrescentibus vestitis inter alia differt.

Herba perennis. *Caulis* erectus, usque 25 cm. altus, simplex vel rarissime ramosus obtuse quadrangulus superne sparse pubescens vel villosus. *Folia basalia* longe petiolata: lamina late cordata ovata obtusa crenata, 5–7 cm. longa, 4–6 cm. lata, utraque pagina adpresse pubescente, petiolo pubescente c. 7 cm. longo. *Folia caulina* plerumque nulla. *Bracteæ* oblongo-ellipticæ sessiles crenatæ utraque pagina pubescentes, usque 4 cm. longæ, 2 cm. latæ. *Bracteolæ* numerosæ lineares calycem fere æquantes pilis fuscis patulis vestitæ, apice spinoso. *Flores* densius verticillati, verticillis 3 cm. diametro. *Calyx* truncatus pilis fuscis patulis flexuosis sparse vestitus, tubo c. 12 mm. longo, 5 mm. lato, dentibus spinosis, 2·5–3·0 mm. longis. *Corolla* pallide rosea; tubo calycem excedente; labio superiore late cordato-ovato cucullato, c. 11 cm. diametro, extra sparse villoso vel pubescente, intus pilis fuscis dense barbato, margine valde denticulato; labio inferiore trilobato, lobo medio orbiculari, c. 4 mm. diametro, præter cristam pilorum externam unicam glabro, lateralibus glabris ovatis obtusis vel suborbicularibus intermedio minoribus. *Stamina* robustiora usque dimidium labii superioris attingentia pubescentia, duobus exterioribus sublongioribus; antheris anguste obreniformibus, fere 2 mm. longis. *Styli* glabri stamina exteriora æquantes breviter et inæqualiter bifidi, ramis subulatis. *Fructus* maturus non visus.

Eastern Himalaya: In open alpine pastures of turf in well-drained situations. Temo La, 4200–4500 m., July 6, 1924 (*F. Kingdon Ward*). 5901 (type). *Also* Yatung, 27° 51′ N., 88° 35′ E. (*H. E. Hobson*) sine numero, comm. anno 1897. Chaethanglaka, 3900 m., Sept. 6, 1911 (*Ribu* and *Rhomoo*), 5282. Lingtu, 3600 m., 1912 (*Rohmoo Lepcha*), 22.

Var. WARDII Marquand et Shaw var. nov. a typo differt foliis cordatis late oblongis attenuatis crenatis subduplo majoribus labio superiore extus densius villoso.

S.E. TIBET : Flowers purple. On the edges of cultivated fields. Tumbatse, 3400 m., July 14, 1924, *F. Kingdon Ward.* 5937.

ERIOPHYTON WALLICHIANUM Benth. in Wall. Pl. As. Rar. i, 68.

Flowers more or less over, purple. Whole plant scented like *Lamium.* On slate screes at Atsa, 4800–5100 m., Aug. 27, 1924. 6158.

LEUCOSCEPTRUM CANUM Smith Exot. Bot. ii, 113, t. 116.

Flowers cream, the exserted stamens giving to the long spike a bottlebrush appearance. In thickets on the open flanks of the hills. E. Bhutan, 26° 30′ N., 91° 30′ E., 1800 m., Feb. 20, 1925. 6436.

POLYGONUM ALPINUM All. Fl. Pedem. ii, 206, t. 68, fig. 1.

Flowers white. Forming large clumps in stony ground by streams in the open. Tumbatse, 3400 m., Aug. 5, 1924. 6056.

POLYGONUM AMPLEXICAULE D. Don Prod. Fl. Nep. 70.

Flowers rosy crimson. In pastures under trees or amongst shrubs where the ground is not boggy. Tumbatse, 3400 m., Aug. 5, 1924. 6054.

POLYGONUM FILICAULE Wall. ex Meisn. in Wall. Pl. As. Rar. iii, 59.

Flowers white with purple centre. In thickets by the streams, forming colonies in deep shade. Tumbatse, 3400–3600 m., July 16, 1924. 5941.

POLYGONUM FORRESTII Diels in Notes Roy. Bot. Gard. Edin. v, 258.

Flowers white, flushed crimson at the base. Anthers dark chocolate. In open situations, on banks and in pastures. Nyima La, 4200–4500 m., July 2, 1924. 5892. Flowers cream. On grassy alpine slopes, sheltered amongst *Rhododendron* bushes. Tra La, 4000–4300 m., Aug. 1, 1924. 6046.

POLYGONUM SIBIRICUM Laxm. in Nov. Act. Petrop. xviii, 531, t. 7, f. 2.

Flowers creamy white with bright crimson ovary. In the moist sand of the river's flood channels. Tsela Dzong, 2900 m., May 13, 1925. 5669.

RHEUM TIBETICUM Maxim. ex Hook. f. Fl. Brit. Ind. v, 56.

Flowers at present white like the stem (etiolated) just coming up in open alpine pastures, glaciated valleys, on screes, etc. Rong-chu (east range), Tumbatse, 4500 m., June 18, 1924. 5805. The Tibetans eat the young stems and inflorescences.

OXYRIA DIGYNA Hill Hort. Kew. 158.

In glacial flats at the moraine foot, in boggy ground. Nam La, 4500 m., July 27, 1924. 6023.

MACHILUS KURZII King ex Hook. fil. Fl. Brit. Ind. v, 860.

"Seed a spherical nut." Spreading evergreen tree of 10–12 m. in evergreen temperate rain forest. Tsang-po Gorge, 2400 m., Nov. 27, 1924. 6316.

EDGEWORTHIA GARDNERI Meissn. in Denkschr. Bot. Ges. Regensb. iii, 280, t. 6.

In very young bud, Bush of 3–4 m. in thickets. Tsang-po Gorge, Tibet, 2100–2400 m., Nov. 28, 1924. 6318.

ELÆAGNUS UMBELLATA Thunb. Fl. Jap. 66, t. 14.

Flowers snow-white, smelling strongly of Jasmine. In thickets in the sandy soil of the valley bottom. Tsela Dzong, 2900 m., May 28, 1924. 5707.

VISCUM sp. (No flowers or fruit.)

In thickets on Leguminous and other trees. Forming great bunches particularly on 6375. Tsang-po Gorge, 1500–1800 m., Dec. 7, 1924. 6359.

SARCOCOCCA HOOKERIANA Baill. Monog. Bux. 53.

Flowers white, fragrant; berries blue-black. Growing on very broken ground amongst boulders and large trees in deciduous forest by the river. Tsang-po Gorge, near Pemako-chung, 2300 m., Nov. 18, 1924. 6277.

BUXUS SEMPERVIRENS Linn. Sp. Pl. 983.

Flowers cream. Foliage olive-green turning orange and scarlet. On limestone cliffs and rock slopes, on the sunny side of the valley. Growing in dense thickets above Nang Dzong, Tsang-po Valley, Tibet, 3400–4000 m., May 2, 1924. 5642.

DAPHNIPHYLLUM HIMALAYENSE (Benth.) Muell. Arg. in DC. Prod. xvi, 1. 4.

In fruit. On steep open north-facing earth slopes below the dense *Rhododendron* forest. Pemako-chung, Tsang-po Gorge, 2700–3000 m., Nov. 21, 1924. 6305.

ULMUS PUMILA Linn. Sp. Pl. 226.

Many trees in fruit but not in leaf. Common in villages, monasteries, etc., in the dry stony side valleys above the river. At its best a fine tree of 50 to 60 feet, but generally small and pollard. Tsetang, Tsang-po Valley, Tibet, 3600 m., April 24, 1924. 5617.

ANDRACHNE CHINENSIS Bunge Enum. Pl. Chin. Bor. 59.

Flowers pale green. Bush or shrub of 2–3 m. in sheltered places, hedges, gullies, etc. Tsela Dzong, 3000–3400 m., May 23, 1924. 5698.

FICUS FOVEOLATA Wall. ex Miq. in Ann. Mus. Lugd. Bat. iii, 294.

Hanging down from trees as an epiphyte or spreading over boulders in the thick semi-tropical forest. Tsang-po Gorge (Gompo Ne), 1500–1800 m., Dec. 9, 1924. 6369. Climbing on large trees, chiefly oak, in the middle forest. Tsang-po Gorge (Gompo Ne), 2000–2500 m., Dec. 11, 1924. 6387.

FICUS sp. n.? (Figs with gall flowers; insufficient for diagnosis.)

In fruit. Small tree of 10 m. in the lower forest of the Tsang-po Gorge, near Gompo Ne, 1500–1800 m., Dec. 4, 1924. 6343.

BETULA JAPONICA Siebold apud Winkler in Engl. Pflanzenr. iv, 61. 78, var. SZECHUANICA Schneid.

Slender tree 6 m. high. Growing on a steep sheltered shrub-clad slope where a stream ran down to the river. Growing with willow, poplar, etc., 20 miles east of Tsetang, Tsang-po Valley, Tibet, 3500 m., April 24, 1924. 5621. Small tortured tree with ascending trunk growing in birch copse on a steep slope. The trunks grow down the slope and then turn upwards, growing erect. Bark red. Doshong La, 3000 m., Oct. 1924. 6451.

QUERCUS INCANA Roxb. Hort. Beng. 104.

Tree of 15–20 m. with spreading habit, branched all the way. In the forest along the open grass-clad ridge above Gompo Ne in the Tsang-po Gorge, 1800 m., Dec. 7, 1924. 6355.

QUERCUS ?SEMISERRATA Roxb. Hort. Beng. 68. (Without flowers or acorns.)

A huge tree 30–40 m. high and 6–7 m. in girth 1·5 m. from the ground. In the middle rain forest with *Tsuga*, etc., at Payi in the Tsang-po Gorge, 2400 m., Dec. 2, 1924. 6336. A large tree up to 40 m. high and of ample girth. One specimen measured 6 m. in circumference 1·5 m. from the ground. Bark flaking in curved segments, as in *Platanus*, but not piebald. In mixed forest with *Tsuga*, *Pinus*, etc., in the Tsang-po Gorge near Gompo Ne, 2100–2400 m., Dec. 6, 1924. 6358.

SALIX AMYGDALINA Linn. Sp. Pl. 1016, var. NIPPONICA Schneid. in Pl. Wils. iii, 106. (♂ specimen.)

A larger plant than 5618 (*S. babylonica* Linn.), forming a large spreading bushy shrub or tree, 6 m. high in the river-bed. Tsetang, Tibet, 2800 m., April 4, 1924. 5619.—The tree is nearly always pollard.

SALIX ANNULIFERA Marquand & Shaw sp. n. ex affinitate *S. opsimanthæ* Schneider sed bracteis ovatis truncato-emarginatis perulis annulatis trifidis persistentibus differt.

Suffrutex nanus, c. 30 cm. altus. *Rami* patentes griseo-brunnei nodosi. *Ramuli* primum parce villosi mox glabrescentes. *Perulæ* in annulum trilobatum persistentem coalitæ, lobis deltoideis subacutis. *Folia* obovata petiolata, 2–5 cm. longa, 1·5–4 cm. lata, basi cuneata vel raro rotundata, margine obscure serrulato ; pagina superiore glabra vel parcissime tomentella, pagina inferiore glauca primum parce villosa ; petiolo usque 1·5 cm. longo. *Amenta plantæ masculæ* c. 3 cm. longa, c. 5 mm. diametro. *Bractea* dense villosa oblonga abrupte truncata, basi angustata, apice subcrenulato, 2·5 mm. longa, 1·7 mm. lata. *Glanduli* oblongo-lanceolati obtusi, c. 1 mm. longi, ventrali submajore. *Stamina* duo ; filamentis 5–6 mm. longis, totis dense villosis. *Amenta plantæ femineæ* c. 4 cm. longa, c. 6 mm. diametro, axi dense pubescente. *Bractea* ovata truncato-emarginata, c. 2·5 mm. longa, c. 1·5 mm. lata, parce pubescens. *Ovarium* obpyriforme tomentosum, 4–5 mm. longum. *Styli* recurvati circinati glabri, apice bifidi. *Amenta fructifera* usque 1 cm. diametro.

S.E. TIBET : ♂ and ♀ on steep rocky cliffs and slopes with dwarf *Rhododendron* etc. Doshong La, 3600–3900 m., June 29, 1924, *F. Kingdon Ward* 5870 (type).

Var. MACRIULA Marquand & Shaw var. nov. a typo differt amentis fœmineis ad 11 cm. longis.

♀ only, in fruit. Scrub plant of 0·5–1 m. on stony meadow slopes, facing south ; mixed with many other shrubs and small trees at the upper tree limit. Doshong La, Pemako, 3400 m., Oct. 23, 1924, *F. Kingdon Ward* 6239.

SALIX sp. peraffinis *S. argyrophegga* Schneid. a qua bracteis multo majoribus differt.

Erect undershrub of 0·3–1 m. covering stony ground, or growing in thickets on more or less south-facing slopes. Doshong La, 3000–3600 m. In fruit, Oct. 22, 1924. 6241.

This specimen probably belongs to an undescribed species but unfortunately is too incomplete for diagnosis.

SALIX BABYLONICA Linn. Sp. Pl. 1017.

A close bushy shrub growing about 5 m. high, in the sand of the river bed, and forming dense thickets. Associated with *S. amygdalina* Linn. var. *nipponica* Schn. Tsetang, Tibet, 2800 m., April 22, 1924. 5618 (♂ specimen). It also grows as a small tree, nearly always pollard.

♀ with leaves not yet expanded. Tsang-po Gorge at Pemako-chung, 2400–2700 m., Nov. 20, 1924. 6296.

SALIX CALYCULATA Hook. fil. ex Anderss. in Journ. Linn. Soc. iv, 55.

Forming hassocks and mats on gravel chutes and stony platforms, mostly facing north. In fruit. Doshong La (Pemako), 3400–3600 m., Oct. 23, 1924. 6242.

SALIX ?FLABELLARIS Anderss. in Vet.-Akad. Handl. 1850, lxxi, 2. 497 (1852).

In fruit. Undershrub of 30–60 cm., forming thickets on open, stony ground by the torrent, principally on north-facing slopes. Doshong La, Pemako, 3400–3600 m., Oct. 23, 1925. 6243.

SALIX OPACA Anderss. ex Herder in Act. Hort. Petrop. xi, 428.

Tree of 6 m. growing by streams on sheltered slopes, or in villages. Usually pollard. 20 miles east of Tsetang, in the Tsang-po Valley, Tibet, 3500 m., April 24, 1924. 5622 (♂ with leaves not yet expanded). Growing in villages, generally pollard. Trap, Tsang-po Valley, Tibet, 3500 m., April 25, 1924. 5624 (♀ with young leaves).

SALIX SIKKIMENSIS Anderss. in DC. Prodr. xvi, 2, 269.

Specimens of both ♂ and ♀ trees. Leaves not yet developed. Shrub of 5–6 m. growing in the more open *Picea* forest, on the south flank of the hill, or in thickets in the valley. In the ♀ the bracts are fringed with long silver hairs, giving the whole catkin a glistening effect; they are often crimson at the tip, and the style is crimson in the young stage. Styles 2, each with 2 green stigmas. In the ♂ the young anthers are brick-red, changing to golden yellow; bracts fringed with long hairs. Temo La, 3900–4200 m., June 7, 1924. 5755.

POPULUS ALBA Linn. Sp. Pl. 1034.

In villages all along the valley. Not seen in fruit or flower. Pe, Tsang-po Valley, 2700 m., June 30, 1924. 5885.

POPULUS CILIATA Wall. apud Royle Ill. Bot. Himal. i, 346, t. "84 *a* or 98," fig. 1, var. AUREA Marquand & Shaw var. nov. a typo differt foliis junioribus subtus aureo-tomentosis.

"Big tree 100 feet high [30 m.] and more. The leaves not yet fully out are purplish red above and beneath are covered with a netted skein of fine golden hairs which secrete a gummy substance."

S.E. TIBET: In villages. Tsela Dzong, 2900 m., May 15, 1924, *F. Kingdon Ward* 5675.

JUNIPERUS INCURVA Buch.-Ham. ex Endl. Syn. Conif. 18.

Large tree of 20–25 m. in temperate evergreen rain forest, first noticed with a large *Magnolia* and *Pinus*, 6315 [*Pinus excelsa* Wall.]. Tsang-po Gorge, 2400 m., Nov. 27, 1924. 6314.

TAXUS WALLICHIANA Zucc. in Abh. Akad. Muench. iii, 803, t. 5.

In mixed forest, with oak, *Rhododendron*, etc. Distributed through the Tsang-po Gorge, near Pemako-chung, but nowhere abundant, 2400–2700 m., Nov. 20, 1924. 6292.

PINUS ARMANDI Franch. Pl. David. i, 285, t. 12.

In mixed forest in the lower part of the ravine, in well-sheltered situations. Doshong La, 2700–3000 m., June 20, 1924. 5882.

(Probably this species but uncertain in the absence of cones.)—Tree of 100–150 feet in height, forming extensive forests by itself or mixed with *Picea*, on steep slopes at the upper end of the Tsang-po Gorge, Gyala, 2700–3000 m., Nov. 17, 1924. 6282.

PINUS EXCELSA Wall. ex Lamb. Pin. ed. 2, i, 40, t. 26.

A very large tree (150–200 feet in height) in the evergreen temperate forest with *Magnolia*, *Rhododendron*, etc. Scattered and not in clumps. Tsang-po Gorge, 2100–2400 m., Nov. 27, 1924. 6315.

PINUS SINENSIS Lamb. Gen. Pin. iii, t. 2.

Forming forests by itself on the drier slopes, or in the valley. Tsang-po Valley, below Nang Dzong, 3400 m., May 6, 1924. 5649. First seen above Nang Dzong mixed with *Picea* etc.

PINUS sp. aff *P. sinensi* Lamb. (*Indet.* in the absence of cones.)

Tree of 70 feet in height, scattered on open bracken and Alder-wooded slopes in the Tsang-po Gorge, near Gompo Ne, 1800–2100 m., Dec. 4, 1924. 6345.

PICEA sp. (*Indet.* in the absence of cones.)

Forming forests on sheltered slopes or scattered through *Picea* and *Rhododendron* forest. Tsang-po Valley (east of Nang Dzong), Tibet, 3400–4000 m., May 6, 1924. 5651.

TSUGA BRUNONIANA Carrière Conif. ed. 1, 188.

Large spreading tree 150 feet high, in mixed forest down by the river. Tsang-po Gorge, 2400–3000 m., Nov. 19, 1924. 6287.—Also noted as enormous trees in forest above Gompo Ne. The Tibetan name is "Cha."

TSUGA sp. (*Indet.* in absence of cones).

Large forest tree mixed with *Picea* and *Rhododendron*, in sheltered glens and on the shaded side of the mountain. Tsela Dzong, 3400 m., May 29, 1924. 5713.

ABIES WEBBIANA Lindl. in Penny Cyclop. i, 30.

A large tree, upwards of 140 feet high, in forest with *Tsuga*, *Rhododendron*, etc. Tsang-po Gorge, 3000–3400 m., Dec. 1, 1924. 6332.

ABIES sp. (*Indet.* in the absence of cones.)

Tree of 40–50 feet in height, forming forests in the *Rhododendron* undergrowth on the sheltered slope of the mountain. Tsela Dzong, 4300 m., May 14, 1924. 5674.

LARIX GRIFFITHII Hook. fil. & Thoms. in Hook. fil. Illustr. Himal. Pl. t. 21 (? in the absence of cones).

A fine tree, upwards of 100 feet high. Forming forests on the shaded slopes of the mountains and filling gullies in the Tsang-po Valley, below Nang Dzong, Tibet, 3400–4000 m., May 6, 1924. 5650.

HABENARIA CHRYSEA W. W. Sm. in Notes Roy. Bot. Gard. Edin. xiii, 204. (*Det.* V. S. Summerhayes.)

Flowers cream. Very frequent in alpine pastures. Tra La, 3900–4200 m., Aug. 1, 1924. 6036.

IRIS CLARKEI Baker ex Hook. f. Fl. Brit. Ind. vi, 275.

Flowers rich violet, with the texture of velvet, the falls streaked with golden yellow. A rhizomatous plant growing in large patches in the grassy pastures by the riverside, scattered amongst trees at Rong-chu, Tumbatse, 3600 m., June 15, 1924. 5783.

IRIS ? GONIOCARPA Baker in Gard. Chron. ii, 710.

Flowers violet with yellow crests on the falls. Open sunny hillsides covered with oak scrub, in sandy soil. Tsela Dzong, 2800–3000 m., May 13, 1924. 5668. Flowers bluish purple, with egg-yellow crests on the falls and a mottling of white below. Growing in clumps in the open pastures at the bottom of the valleys. Often mixed with *I. Clarkei* (No. 5783). Rong-chu, Tumbatse, 3600 m., June 15, 1924. 5787.

IRIS sp. n.? (Material insufficient for description.)

Flowers more or less purple or purplish violet. Falls mottled, standards paler; crest orange. Plant of 20–30 cm. when fully grown, occupying open meadows and grassy ridges in the upper forest belt at Tsela Dzong, 3900–4200 m. Just flowering May 30, 1924. 5719.

ALETRIS GRACILIS Rendle in Journ. Bot. xliv, 41.

Flowers white, tinged pink; anthers red. In marshy meadows. Tumbatse, 3000–3600 m., July 13, 1924. 5933.

POLYGONATUM sp.? (*Indet.* in absence of flowers or fruit.)

In the lower rain forest, as undergrowth or epiphytic at Payi, Tsang-po Gorge, 2100 m., Dec. 12, 1924. 6337.

ALLIUM HOOKERI Thwaites Enum. Pl. Zeyl. 339.

Flowers cream. Plant of 30–60 cm. Growing in meadows, abundant on the Nambu La, 3000–3600 m., Aug. 13, 1924. 6084.

ALLIUM JACQUEMONTI Regel in Act. Hort. Petrop. iii, 2. 162.

Flowers purple. On grassy slopes of granite cliffs. Atsa Tso, 3900–4200 m., Aug. 26, 1924. 6147.

ALLIUM KANSUENSIS Regel in Act. Hort. Petrop. x, 590.

Flowers bright violet. In sheltered nooks on the gneiss cliffs. Nam La, 4200–4500 m., July 26, 1924. 6015.

ALLIUM YUNNANENSE Diels in Notes Roy. Bot. Gard. Edin. v, 301.

Flowers light purple more or less speckled. In sandy or gravelly soil under trees by the river. Tong-kyuk, 2700–3000 m., Aug. 10, 1924. 6076.

LILIUM HYACINTHINUM E. H. Wilson Lil. East. As. 100.

Flowers purple, without scent. In shady pastures and on the edge of the forest. Tumbatse, 3600–3900 m., July 3, 1924. 5893.—Also noted as abundant in alpine meadows elsewhere.

LILIUM TALIENSE Franch. in Morot, Journ. de Bot. vi, 319.

Flowers pink, the perianth segments heavily spotted with purple, except towards the tips, which are clear. Very fragrant plant of 60–90 cm. growing on the bush-clad slopes, amongst grass, ferns, oak scrub, etc. Not common and generally scattered. Gorge of the Tsang-po, near Gyala, 2400–3000 m., July 29, 1924. 6034. Abundant on bracken- and pine-clad slopes, with "*Virgatum*" *Rhododendron.* Grows to 1·2 m. high bearing 12–20 flowers. In full bloom Aug. 10, 1924 (*F. K. W.*).

LILIUM TIGRINUM Ker-Gawler in Bot. Mag. t. 1237.

Flowers rich golden orange-red, evenly spotted (except the upper third of the petals) with dark purplish brown. Plant of 1·5 m. with no scent. Bulbils freely developed in the leaf axils. Stem densely rooted just above the bulb, which is shallow—about 15 cm. down. Growing in masses amongst grass, rocks and peach-trees. Gyamda River, near Tsela Dzong, 3000 m., Sept. 7, 1924. 6175. "The bulbs are not eaten here, but branches of the flowers are placed on family shrines in monasteries etc." (*F. K. W.*).

LILIUM WALLICHIANUM Schultes fil. Syst. vii, 1689.

On very steep rocky slopes covered with long grass and bracken with *Pinus* sp. and *Rhododendron arboreum*. The bulb is only a few inches below the surface in very fine dry sandy soil mixed with numerous large angular stones, derived from micaceous schists. E. Bhutan, 1200–1500 m., Feb. 19, 1925. 6428.

The original specimen was indeterminable as it was only in fruit, but one of the bulbs brought home flowered in 1926 and proved that it belonged to the above species.

LILIUM sp. (*Indet.* in fruit only.)

There are possibly two species confused here. Not seen in flower. On south-facing steep alpine slopes, amongst herbs and small bushes. Doshong La and Pemako, 3000–3600 m., Oct. 20, 1924. 6232.

FRITILLARIA CIRRHOSA D. Don Prod. Fl. Nep. 51.

Flowers nodding, yellowish green, irregularly freckled with purple on the inside ; more or less purple on the outside. On earth banks, amongst scrub on loamy soil, facing south. Temo La, 4000–4300 m., June 6, 1924. 5748.

Var. BRACHYANTHA Marquand & Shaw var. nov. a typo differt floribus minoribus, perianthii segmentis 1·5–2·0 cm. longis fere totis nigro-suffusis.

Collected with above, *F. Kingdon Ward* 5748.

NOMOCHARIS NANA (Klotzsch) E. H. Wilson Lil. East. As. 13 [=*Lilium nanum* Klotzsch Bot. Reis. Pr. Waldem. 53.].

Perianth segments light plum-purple, with a very dark mark at the base of each inner segment round the ovary ; also a crest of green fleshy processes which can hardly be called hairs. Ovary and filaments green ; anthers purplish brown, actually versatile but erect in the flower Bulb with linear scales typically Nomocharoid. On sheltered earthy banks amongst dwarf *Rhododendron*. Nyima La, 4200–4500 m., June 20, 1924. 5809.

LLOYDIA DELAVAYI Franch. in Morot, Journ. de Bot. xii, 193.

Flowers bright yellow with brown marking at the base of the corolla. On alpine turf slopes facing south. Doshong La, 4000 m., June 15, 1924. 5854. Also seen at Temo La.

LLOYDIA OXYCARPA Franch. in Morot, Journ de Bot. xii, 192.

Flowers sulphur-yellow. On steep alpine turf slopes, sheltered under *Rhododendron* bushes. Rong-chu (Tumbatse), 4000–4300 m., June 18, 1924. 5799.

LLOYDIA SEROTINA Sweet Hort. Brit. ed. 2, 527.

Flowers white. On a limestone outcrop on the east side of the valley. Rong-chu (Tumbatse), 3600–3900 m., June 17, 1924. 5793.

Forma PARVA Marquand & Shaw f. n. a typo differt habitu humiliore et graciliore.

S.E. TIBET: Forming masses on steep alpine turfy slopes near the limit of the *Rhododendron* forest; "covering the ground like dwarf snowdrops." Rong-chu (Tumbatse), 4300 m., June 18, 1924, *F. Kingdon Ward* 5798.

This form is smaller and more slender than the type, 6–8 cm. high. *Flowers* 8–9 mm., white, tinged purple on the reverse. *Filaments* glabrous. *Style lobes* erect.

LLOYDIA TIBETICA Baker ex Oliv. in Hook. Ic. Pl. xxiii, t. 2216.

Flowers white, brownish orange inside. In alpine pastures. Tra La, 4200–4500 m., Aug. 1, 1924. 6037.

TRILLIUM sp. (*Indet.* in the absence of flowers and fruit.)

"Berries pendent, scarlet, in spreading racemes." Amongst undergrowth in thick forest in the Tsang-po Gorge, near Pemako-chung, 2500–2700 m., Nov. 20, 1924. 6295. No berries were received with the specimen.

ARISÆMA FLAVUM (Forsk.) Schott Prod. Aroid. 40.

Spathe dull yellow, striped broadly with dull chocolate within. In soft loam, in the neighbourhood of cultivation. Tsang-po Valley, below Tsetang, Tibet, 3000–3400 m., April 29, 1924. 5629.

ARISÆMA WARDII Marquand & Shaw sp. n. § *Tenuipistillatæ* Engl. affinis *A. Jacquemontii* Bl. a qua specie spadicis appendice haud vel vix exserto crassius stipitato basi haud truncato imprimis differt.

Tuber oblato-sphæroideus, c. 2 cm. diametro. *Caulis* erectus, usque 4 dm. altus (usque ad flexionem spathæ). *Cataphylla* membranacea nitentia, infimo c. 6 cm. longo, altero c. 17·5 cm. longo, apice obtuso. *Folia* duo: basi membranacea vaginante auriculata, 5–7 mm. lata; petiolo gracili, 6–7 cm. longo ab apice vaginæ usque ad basin foliolorum. *Foliola* quinque radiantia elliptico-oblonga basi et apice attenuato-caudata, 5–9 cm. longa, 1·5–2·8 cm. lata, glabra, nervis pinnatis duobus etiam margini parallelis proximisque plerumque percurrentibus. *Spatha* c. 16 cm. longa (a basi usque ad caudæ apicem): tubo fere cylindrico sursum pergradatim ampliato, c. 6 cm. longo, 1·0–2·0 cm. diametro, fauce (ostio) haud vel vix auriculata; limbo ovato, 3·5 cm. diametro maximo, apice longe caudato-acuminato pendente. *Spadix* plantæ femineæ 6·5 cm. longa, 3–4 mm.

diametro; appendice 3 cm. longa, supra basin leviter ampliata sed haud truncata, in apicem obtusum vix angustata, spathæ faucem (ostium) haud vel vix excedente. *Flores feminei* conferti (spadicis parte florifera 4·5 cm. longa) ovoideo-utriculati, 2·5–3·0 mm. longi, glabri. *Stigma* simplex levissime inflatum. *Ovula* quatuor. *Fructus* maturus non visus. *Planta mascula* non visa.

S.E. TIBET: Spathe pale green with thin white stripes. In pastures and open woods by the river. Rong-chu (Tumbatse), 3600 m., June 15, 1924, *F. Kingdon Ward* 5785.

ARISÆMA sp. (Material insufficient for specific identification.)

Spathe striped purplish brown on a greenish background. In heavy forest, on banks. "No sign as yet of any leaf." East Bhutan, 26° 0′ N., 91° 0′ E., 1200–1500 m., Feb. 21, 1924. 6443.

ARUNDINARIA sp. indet. (barren).

Plant of 6 m., stem pale green; growing in large clumps in Conifer forest, as undergrowth. Very thick in shady glens by streams. Tsang-po Gorge, below Gyala, 2700–3000 m., Nov. 16, 1924. 6270.

ARUNDINARIA sp. indet. (without flowers).

Plant of 6–7 m., the long slender stems gracefully bowed. Forming a fairly dense and continuous growth on the more sheltered slopes of the valley mixed with scrub oak; not defined into compact clumps. Rong-chu, below Tong-kyuk, 2100 m., Dec. 25, 1924. 6399.

ARUNDINARIA sp. indet. (barren).

Leaves in large tufts. Forming an almost impenetrable barrier in the semi-tropical forest around Gompo Ne, in the Tsang-po Gorge, 1500–1800 m., Dec. 9, 1924. 6367.

DENDROCALAMUS ? PATELLARIS Gamble Bamb. Brit. Ind. in Ann. Bot. Gard. Calc. vii, 86, t. 75 (barren).

In thick semi-tropical forest, growing in clumps. The weak stems flop over after reaching a length of 3 m. or so. Gompo Ne, in the Tsang-po Gorge, 1500–1800 m., Dec. 19, 1924. 6368.

NOTE (p. 162). The nomenclature of No. 5804 should read as follows:—

PEGÆOPHYTON SCAPIFLORUM (Hook. fil. & Thoms.) Marquand & Shaw, comb. nov.
Cochlearia scapiflora Hook. fil. & Thoms. in Journ. Linn. Soc. v, 154.
Braya sinensis Hemsl. in Journ. Linn. Soc. xxix, 303, t. 29.
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Marine Algæ of some German Warships in Scapa Flow and of the Neighbouring Shores. By Miss LILIAN LYLE. (Communicated by Dr. A. B. RENDLE, F.R.S.)

(With 9 Text-figures.)

[Read 3rd May, 1928.]

CONTENTS.

	Page
Introduction	231
Physical Features of Scapa Flow	232
Configuration of the Coast	233
The Flora of the Wrecks	234
List of Algæ collected on Wrecks and on Neighbouring Shores at Scapa Flow	236
Condition and Zonation of the Wreck Flora	241
Notes on the Additions to the Marine Flora of Orkney	243
Origin of Novelties, British and Foreign	250
Types of Marine Flora of the Coast	251
Comparison of Wreck Flora with that of Adjacent Shores	254
Some Differences between Coast and Wreck Floras	255
References	256

INTRODUCTION.

The study of algæ on the sides of ships has hitherto received little attention. Murray (32) pointed out the value of such research as likely to yield information on geographical distribution etc.; and there are various instances of algæ which must have been carried from other countries being found on ships' sides or in the mouths of harbours.

The investigation of the salvaged monitor 'Glatton' in 1926 (29) indicated a possibility of further success in this direction, and it was decided, therefore, to take advantage of the salvaging of the sunken German Fleet in Scapa Flow to study the vegetation on the wrecks. A visit was paid from Aug. 26th to Oct. 13th, 1926. It would obviously have been more profitable from the botanical standpoint if the salvaging of the vessels had taken place some eight years earlier, but the opportunity offered in 1926 was so unusual as to be valuable. The following vessels were examined:— 'Seydlitz,' lying on its side, with 20 ft. above water; 'Moltke' and 'Kaiser,' both upside down, with a few feet of keel exposed at low water; a Destroyer, only the lower part submerged; 'Von der Tann,' overturned and submerged to a depth of 6–8 ft.; 'Hindenburg,' partially raised. The last had been scraped and hence yielded few specimens, but the marine growths on the other vessels were undisturbed.

Specimens were gathered at low water, and from varying depths down to 72 ft. It was hoped that species from the Baltic or elsewhere might be found. The flora of the wrecks was, however, for the most part Orcadian; but careful search revealed some algæ hitherto known only from the Baltic. Submergence for eight years greatly militated against the chance of finding many foreign specimens. It is also possible that others may have arrived with the vessels, but had died off under the changed conditions.

Collections for comparison were also made on the adjacent shores, and in all 167 species and varieties were gathered. Of these 121 species and varieties, including three novelties (one new to science), were taken from the wrecks. Thirty-six additions were made to the marine flora of Orkney, and one of the species found on the coasts is new to Britain.

A small motor-launch with rowing-boat in tow was employed. In addition to hand-collecting, a triangular dredge was used. This had a cutting-edge and the apex was attached to a 12-ft. pole. By scraping the sides of the wrecks abundant hauls from depths of 3–8 ft. were secured in the net. For greater depths a larger dredge was used and this was lowered by a chain. A diver's assistance was requisitioned: he made two descents, bringing up samples from 40 ft. and from 72 ft.

PHYSICAL FEATURES OF SCAPA FLOW.

Scapa Flow resembles an inland sea, measuring ten miles across and four miles north and south. It is sheltered on all sides by the islands of South Orkney. Pomona or Mainland lies on the north and east side, Hoy, Flotta, and Fara extend along its western and southern shores, while South Ronaldsay closes the circle to the south-east.

The tidal stream flows from the Atlantic into the North Sea between Norway and the British Isles, and passes through the various channels formed by the Shetlands, Orkneys, and the north coast of Scotland. The opposition of the Orkneys to the tidal wave from the Atlantic causes great velocity in the stream in the Pentland Firth (35). A branch of it flows through Hoy Sound at the rate of eight knots; but, becoming spread out in the Flow, decreases to three knots. It passes out through Hoxa Sound and joins the main stream in the Firth. There is very little tidal movement in the centre of Scapa Flow, the tide-range is 10 ft. only, and the water behind the islands of Cava, Fara, and Flotta, lying along the eastern side of Hoy, is only slightly influenced by the tidal wave. It was in this locality that the wrecks were situated.

Owing to the numerous streams flowing from the mountainous island of Hoy, the water on its eastern side is of a low degree of salinity—2·5 per cent. According to Oltmanns (**34**), enclosed seas, *i.e.*, without streams, should have a high degree of salinity—the normal is about 4 per cent.

The small size of the specimens found and scarcity of rare and delicate species was doubtless due to this fact, or to the presence of oil, for Reinke (**37**) remarks how plants accustomed to a high degree of salinity decrease in size or change in shape if subjected to a low salinity, as in the Baltic.

The following facts on the physical condition of the Orkneys are taken from 'The Orkney Book' (**17**).

The presence of the "Gulf Stream" bathing the shores of Orkney so influences the air temperature that a mean of 45°·4 with a range of 68° is the result. This is a little less than that of Kew, with a mean temperature of 49°·4. To the same cause may be ascribed the absence, with few exceptions, of extremes of heat or cold, drought or flood. The temperature of the ocean varies only 13° during the year. It is lowest in February, being 41°·6, that of the air being 38°·6, and is highest in August, being 54°·5 when that of the air is 54°.

The Germans used poor coal. To produce more heating power they sprayed it with oil, or used oil entirely as a fuel. This was a mineral oil in its natural state, thick, bituminous and heavy, from which petrol could be distilled. A portion floated on the surface, but the greater part, being heavier than water, sank to the bottom. Thus, in the neighbourhood of the wrecks, the sea-floor, though composed of rock, is knee-deep in oily black mud. It spread over the shores, especially where there were low sandy beaches, coating everything—rocks, stones, seaweed, etc.—with a thin layer of greasy blackness. In manipulating the seaweed one's hands acquired a grime, and the plants were frequently so filthy that they could be touched only with forceps.

The oil affected the birds, but not, so it was said, the fish. The green and brown and the coarser red algæ flourished in spite of it, but many of the more delicate species were stunted in growth or absent.

CONFIGURATION OF THE COAST.

Only that part of the eastern coast of Hoy between Longhope and Green Head, including Risa Isle, was examined. The islands of Cava, Fara, and Flotta screen these shores from the rest of Scapa Flow, so there is considerable shelter from weather conditions. Two types of coast-line were noticed —a little promontory north of Mill Bay (Point of Cletts) formed the line of demarcation between them:—(1) Beginning at the south and working northwards, from Longhope, along North Ness, Ore, and Mill Bays, the shores are flat, with low rocks, sand, stones, and mud bounded on the landward side by low earth banks. Grassy meadows lie inland traversed by peaty burns. Owing to the influx of these streams, the water in the bays is slightly brackish. (2) At Point of Cletts conditions change, the coast becoming more rocky. Low banks of earth are continuous for a time, but a boulder beach makes the shore so rough and dangerous that the water's edge is approached with difficulty. Risa Island is of the same nature, so a small rowing-boat was necessary for collecting and dredging, as it could be easily moved about among rocky inlets. Further north at Green Head the cliffs are high and steep, with broken and fallen rocks descending to the sea. Beyond Green Head, the cliffs of Hoy stand high out of the water, with little or no beach: towards the north end, at the foot of Ward Hill, which dominates that part of the island, they gradually cease, giving place to a sort of talus of a peaty nature (**18**).

THE FLORA OF THE WRECKS.

The 'Hindenburg,' with masts and funnels showing, lies sheltered by Cava, halfway between Lyness and Stromness, in about 11 fathoms of water.

Much of the vegetation had been removed owing to salvage operations. From the sides hung some withered *Porphyra* and *Desmarestia*, while below, beneath the water, could be seen numerous Laminarias. Owing to certain experiments the stern rose unexpectedly during the visit, and from a turret 32 ft. below high-tide mark twenty-two species were taken. The most interesting included:—*Monostroma fuscum* var. *Blyttii*, *Delesseria sinuosa* var. *lingulata*, an unusual basal growth-form of *Antithamnion plumula*, and a large number of epiphytes on *Odonthalia dentata*.

The 'Von der Tann' lies bottom upwards between Green Head and Cava, at right angles to the 'Hindenburg,' and at a depth of about 8 ft. Specimens from 16 to 20 ft. down were obtained, mostly *Laminaria saccharina* and *Desmarestia aculeata*. *Trailliella intricata* grew over the rhizoids of the latter. *Brogniartella byssoides*, *Bonnemaisonia asparagoides*, and *Heterosiphonia coccinea* were entangled among the branches. Altogether about eighteen species were collected.

The 'Seydlitz' lies on its side a little to the south of the 'Hindenburg' with 20 ft. exposed. For several feet above high-water mark down to half-tide a green band encircled the wreck composed of *Enteromorpha minima* with *Protococcus marina* and fringes of *Enteromorpha compressa* below. Still further down were scattered tufts of *Pylaiella litoralis* f. *longifructus* and *Porphyra umbilicalis*. Alarias marked the limit of low tide. Very large Laminarias overgrown with Flustræ, Sertularias, and Ascidians were dredged from 7 ft.

Delicate and rare species, such as *Lomentaria rosea, Phyllophora Traillii, Callithamnion polyspermum*, etc., grew in the semi-darkness of port-holes and gratings.

Seventy-five species were listed from this ship. Among the most interesting were *Kylinia scapæ*, a species new to science, of which the genus is new to Britain and hitherto known only from the Baltic; *Ectocarpus granulosus* with intercalary unilocular sporangia, *Porphyriopsis coccinea*, *Ectocarpus Sandrianus*, and *Traillie lla intricata*.

The 'Kaiser' lies a few hundred yards to the north of the 'Hindenburg,' where the water is more open and influenced somewhat by the tidal stream. Specimens were cleaner and larger. *Dictyota dichotoma*, *Pylaiella litoralis*, *Laurencia pinnatifida*, *Polysiphonia nigrescens*, *Corallina squamata*, and *Cladostephus spongiosus*, etc., were collected from the overturned keel, on which it was possible to land at low tide. A belt of brown algæ surrounded the ship, with a few plants boring into shells or creeping over them.

Codium mucronatum var. *atlanticum* growing among the rhizoids of *Alaria* and *Pterosiphonia parasitica* var. *repens* creeping over mussel-shells were among the numerous epiphytes. There were fifty species in all.

The 'Moltke' is situated between Cava and Hoy Island, in about 12 fathoms of water, south-east of the 'Hindenburg.' The keel lies exposed at low tide from which many small tufted plants were gathered, including *Cladophora rupestris*, *Ptilota plumosa*, *Scytosiphon lomentarius*.

In order to discover at what depth the brown algæ ceased to grow and what species were to be found below, the services of a diver were employed. The limit of brown algæ was reached at a depth of 40 ft., and twelve species were collected. At 72 ft. from the surface a few red algæ were found—in all six species.

[Since the above was written, the 'Seydlitz' and the 'Moltke' have been salvaged.]

LIST OF ALGÆ COLLECTED ON WRECKS AND ON NEIGHBOURING SHORES AT SCAPA FLOW.

ALGÆ.	New to Orkney.	Above half-tide mark.	Half-tide.	Low tide.	6–11 feet.	16–20 feet.	32 feet.	40 feet.	72 feet.	Baltic.	SHORE LOCALITIES.
Anacystis parasitica Kütz.	×	..	..	..	..	..	..	..	..	..	Green Head.
Dermocarpa Leibleiniæ Born.	×	..	..	×	..	..	..	..	..	..	
Hyella cæspitosa Born. & Flah.	×	..	..	×	..	..	..	..	..	×	
Spirulina tenuissima Kütz.	×	..	..	..	×	..	..	..	..	×	
Oscillatoria margaritifera Kütz.	×	..	..	..	..	..	..	..	..	..	Green Head.
Lyngbya majuscula Harv.	..	..	..	..	..	..	..	..	..	..	Mill Bay.
Symploca hydnoides Kütz.	..	..	..	..	×	..	..	..	..	..	Mill Bay.
Calothrix confervicola Ag.	..	..	..	..	..	..	..	..	..	..	North Ness.
„ *æruginea* Thur.	×	..	..	..	..	..	..	..	..	×	
Isactis plana Thur.	×	..	..	..	..	..	..	..	..	..	Mill Bay.
Rivularia atra Roth.	..	..	..	..	..	..	..	..	..	×	North Ness, Ore Bay.
„ *nitida* Ag.	..	..	..	..	..	..	..	..	..	..	Ore Bay.
Protococcus marina Kütz.	..	×	..	..	..	..	..	..	..	..	
Monostroma fuscum Wittr. var. *Blyttii* Batt.	×	..	..	×	..	..	×	..	..	..	
„ *Grevillei* Wittr.	..	..	..	..	×	..	..	..	..	..	
Percursaria percursa Rosenv.	..	..	..	..	..	..	..	..	..	×	Mill Bay.
Enteromorpha clathrata J. Ag.	..	..	..	..	..	..	..	..	..	×	North Ness, Risa Island, Mill Bay.
„ *compressa* Grev.	..	×	..	..	×	..	..	..	..	×	Green Head, Point of Cletts.
„ *Linza* J. Ag.	..	..	..	×	×	..	..	..	..	×	Green Head.
„ *intestinalis* Link	..	×	..	..	×	..	..	..	..	×	
„ *minima* Näg.	..	×	..	..	..	..	..	..	..	×	
Ulva lactuca L. var. *latissima* DC.	..	..	..	×	×	×	..	×	..	×	Risa Isle, Mill Bay.
Endoderma viride Lagerh.	×	..	..	×	×	..	..	..	..	..	
Chætomorpha linum Kütz.	..	..	..	..	..	..	..	..	..	..	North Ness.
Rhizoclonium arenosum Kütz.	..	..	..	×	..	..	..	..	..	..	
„ *riparium* Harv.	..	..	..	..	×	..	..	..	..	×	North Ness.
Cladophora rupestris Kütz.	..	..	×	×	×	..	×	..	..	×	Green Head, Risa I., Pt. of Cletts, etc.
„ *gracilis* Kütz.	..	..	..	×	×	..	..	..	..	×	

Cladophora sericea Kütz.	..	..	..	×	×	..	..	..	..	×	
,, *arcta* Kütz.	..	..	..	×	×	..	..	..	..	×	Green Head.
,, *lanosa* Kütz.	..	..	..	×	..	..	..	..	..	×	Green Head, Mill Bay.
Gomontia polyrhiza Born. & Flah.	..	..	×	..	..	..	..	..	..	..	Mill Bay.
Ostreobium Quekettii Born. & Flah.	..	..	..	..	×	..	×	..	×	..	
Bryopsis plumosa Ag.	..	..	..	..	×	..	..	..	..	×	
Vaucheria sp.	..	..	..	×	..	..	..	..	..	..	
Codium mucronatum J. Ag. var. *atlanticum* Cotton	×	..	..	..	×	..	..	..	..	..	Orkney and Shetland (not in Baltic).
Desmarestia aculeata Lamour.	..	..	..	×	..	×	×	×	..	×	
Dictyosiphon fœniculaceus Grev.	..	..	..	×	..	..	..	..	..	×	
,, *hippuroides* Kütz.	..	..	..	..	..	..	..	..	..	×	Ore Bay, Point of Cletts, Forth Ness.
Litosiphon Laminariæ Harv.	..	..	..	×	×	..	..	..	..	..	
Punctaria plantaginea Grev.	..	..	..	×	..	..	..	..	..	×	
Scytosiphon lomentarius J. Ag.	..	..	..	×	×	..	..	..	..	×	Risa Island, Ore Bay.
Asperococcus echinatus Grev.	..	..	..	×	..	..	..	..	..	×	Point of Cletts, Risa Island, North Ness.
Ectocarpus terminalis Kutz.	..	..	..	..	×	..	..	..	..	×	
,, *Sandrianus* Zan.	×	..	..	×	×	..	..	..	..	×	
,, *confervoides* Le Jol.	..	..	..	×	×	..	..	..	..	×	
,, *siliculosus* Kütz.	..	..	..	×	×	..	..	..	..	..	
,, *fasciculatus* Harv.	..	..	..	×	..	..	..	..	..	..	
,, *granulosus* Ag.	..	..	..	×	×	..	..	..	..	..	
,, *Hinksiæ* Harv.	..	..	..	..	×	..	..	..	..	..	
Pylaiella litoralis Kjellm.	..	..	×	×	..	..	..	..	..	×	Risa Island, Green Head.
,, ,, var. *longifructus* Batt.	..	..	..	×	×	..	×	..	..	..	Risa Island, Point of Cletts.
Myriotricha filiformis Harv.	..	..	..	×	..	..	..	..	..	..	Risa Island, Point of Cletts.
Elachista fucicola Fries.	..	..	..	×	..	..	..	..	..	×	
Sphacelaria cirrhosa Ag.	..	..	..	×	×	×	×	×	..	×	
,, ,, var. *fusca* H. & B	×	×	..	..	×	..	..	..	..	..	
Cladostephus spongiosus Ag.	..	..	..	..	..	..	..	..	..	..	Mill Bay, Green Head, Risa Island.
Myrionema vulgare Rosenv.	..	..	..	..	×	..	..	..	..	×	Point of Cletts, Risa Island.
Ralfsia pusilla Batt.	×	..	..	..	..	..	..	..	..	..	Risa Island, Green Head.
Lithoderma fatiscens Aresch.	×	..	..	..	×	..	..	..	..	×	North Ness.
Chordaria flagelliformis Ag.	..	..	×	×	..	..	..	..	..	×	Point of Cletts.
Castagnea virescens Thur.	..	..	..	..	..	..	..	..	..	×	Point of Cletts, Risa Island.
Leathesia difformis Aresch.	..	..	×	..	..	..	..	..	..	×	Green Head, Risa Island.
Chorda filum Stackh.	..	..	..	..	..	..	..	..	..	×	Ore Bay, Mill Bay.
Laminaria saccharina Lamour.	..	..	..	×	×	×	×	..	..	..	All along shores.
,, *digitata* Lamour.	..	..	..	×	×	..	..	..	..	×	All along shores.
,, *intermedia* Fosl. var. *longipes* Fosl.	×	..	..	..	..	..	..	..	..	..	Along coast.
Saccorhiza bulbosa De La Pyl.	..	..	..	×	..	..	..	..	..	..	

LIST OF ALGÆ (*cont.*).

ALGÆ.	New to Orkney.	Above half-tide mark.	Half-tide mark.	Low tide.	8–11 feet.	16–20 feet.	32 feet.	40 feet.	72 feet.	Baltic.	SHORE LOCALITIES.
Alaria esculenta Grev.	..	..	..	×	×	..	..	..	..	..	
Fucus ceranoides L.	..	..	..	..	..	..	..	..	..	..	Ore Bay, North Ness, Mill Bay.
„ „ var. *linearis* Batt.	..	..	..	..	..	..	..	..	..	..	Ore Bay.
„ ***spiralis*** L.	..	..	..	..	..	..	..	..	..	..	Green Head, Pt. of Cletts, North Ness.
„ ***vesiculosus*** L.	..	..	×	..	..	..	..	..	..	×	Along coasts.
„ ***serratus*** L.	..	..	..	×	..	..	..	..	..	×	Along coasts.
Ascophyllum nodosum Le Jol.	..	..	..	..	..	..	..	..	..	×	Green Head, Risa Island, North Ness.
Pelvetia canaliculata Dcne. & Thur.	×	..	..	..	..	..	..	..	..	..	Green Head, North Ness, Pt. of Cletts.
Achinetospora pusilla Born.	×	..	..	..	×	..	..	..	..	..	
Dictyota dichotoma Lamour.	..	..	..	×	×	..	..	×	..	..	
Conchocelis rosea Batt.	×	..	..	..	×	..	..	..	..	..	
Erythrocladia irregularis Rosenv.	×	..	..	..	×	..	..	..	.	×	
Erythrotrichia carnea J. Ag.	×	..	..	×	×	..	×	..	..	×	Green Head, Pt. of Cletts, Risa Island.
„ ***Bertholdii*** Batt.	×	..	..	..	×	..	..	..	..	..	
Porphyriopsis coccinea Rosenv.	..	..	..	..	×	..	..	..	..	..	Risa Island.
Porphyra umbilicalis Kütz.	..	..	..	×	..	..	..	..	..	..	
„ „ var. *laciniata* J. Ag.	..	..	..	..	..	..	..	..	..	..	North Ness, Risa Island.
„ ***miniata*** L. var. *abyssicola* Rosenv.	..	..	..	..	..	..	..	..	..	..	Ore Bay, North Ness.
Chantransia cæspitosa (Batt.)	×	..	..	..	×	..	..	..	..	..	Risa Island.
„ ***virgatula*** Thur.	..	..	.	×	×	..	×	..	..	×	Risa Island.
„ „ f. ***luxurians*** Rosenv.	..	..	..	×	..	..	×	..	..	..	Green Head.
„ „ f. ***secundata*** Rosenv.	..	..	..	×	×	..	..	..	..	×	Green Head, Risa Island.
„ ***Daviesii*** Thur.	..	..	..	..	..	..	×	..	..	..	
„ ***hallandica*** Kylin var. *parvula* Rosenv.	×	..	..	..	×	..	..	..	..	×	
Kylinia scapæ Lyle, sp. n.	×	..	..	..	×	..	..	..	..	..	
Gelidium pusillum Le Jol.	..	..	..	..	..	..	..	..	..	..	Risa Island.
„ ***corneum*** Lamour.	..	..	..	..	..	..	..	..	×	..	
Chondrus crispus Stackh.	..	..	..	..	..	..	..	..	..	×	Green Head, Point of Cletts, Risa I.

Gigartina mamillosa J. Ag.	×	..	..	..	..	..	..	..	..	..	Green Head, Risa Island.
Phyllophora Brodiæi J. Ag.	..	..	..	..	.	..	..	..	..	×	Risa Island.
" ***Traillii*** Holm. & Batt.	..	..	..	×	..	..	..	..	..	..	Green Head.
Callophyllis laciniata Kütz.	..	..	..	×	×	×	×	..	×	..	
Callocolax neglectus Schm.	×	..	..	..	×	..	×	..	..	..	
Cystoclonium purpureum Batt.	..	..	..	×	..	..	..	..	..	×	Point of Cletts, Risa Island.
Euthora cristata J. Ag.	..	..	..	..	×	..	..	..	..	..	
Rhodophyllis bifida Kütz.	.	..	..	..	×	..	×	..	×	..	Green Head.
" ***appendiculata*** J. Ag.	..	..	..	..	×	..	..	..	..	..	
Gracilaria confervoides Grev.	..	..	..	..	..	..	..	×	..	..	
Rhodymenia palmata Grev. f. *typica* Grev.	..	..	..	..	×	..	..	..	..	×	Green Head.
" " var. *marginifera* Harv.	..	..	..	..	×	..	..	..	..	..	
" " var. *sarniensis* Grev.	..	..	..	..	..	..	..	..	..	..	North Ness.
Lomentaria articulata Lyngb.	..	..	..	..	×	..	..	..	..	..	Green Head, Risa Island.
" *clavellosa* Gaill.	..	..	..	×	×	..	..	×	..	..	Green Head.
" *rosea* Thur.	×	..	..	×	×	..	..	×	..	..	
Champia parvula Harv.	..	..	..	..	×	..	..	..	..	..	
Chylocladia kaliformis Hook.	..	..	..	..	×	..	..	..	..	..	
Plocamium coccineum Lyngb.	..	..	..	×	×	×	..	×	..	..	Risa Island.
Nitophyllum laceratum Grev. f. *reptans* Lyle	×	..	..	..	×	..	..	..	..	..	
Delesseria sanguinea Lamour.	..	..	..	..	×	..	..	×	×	×	
" *sinuosa* Lamour.	..	..	..	..	..	..	..	..	..	×	Green Head, Pt. of Cletts, Risa Island.
" " f. *lingulata* Ag.	×	..	..	..	×	×	×	×	×	..	
" *alata* Lamour.	..	..	..	..	×	..	..	..	..	..	Green Hd., N. Ness, Ore Bay, Pt. of [Cletts, Risa Island.
" *ruscifolia* Lamour.	..	..	..	..	×	..	..	..	..	..	
Bonnemaisonia asparagoides Ag.	..	..	..	..	.	×	..	..	..	..	
Rhodomela subfusca Ag.	..	..	..	×	×	..	..	..	..	×	Green Head, Risa Island, North Ness.
" *lycopodioides* Ag.	..	..	..	×	..	..	..	..	..	..	North Ness.
Odonthalia dentata Lyngb.	..	..	..	..	×	×	×	..	..	..	
Laurencia pinnatifida Lamour.	..	..	..	×	..	..	..	..	..	..	
Polysiphonia macrocarpa Harv.	..	..	..	×	×	×	×	..	..	..	
" *urceolata* Grev.	..	..	..	..	×	..	..	..	..	×	
" *violacea* Grev.	..	..	..	×	×	..	..	..	..	×	
" *fastigiata* Grev.	..	..	..	..	..	..	..	..	..	..	Where host plant occurs.
" *atro-rubescens* Grev.	..	..	..	..	×	..	..	..	.	..	
" *nigrescens* Grev.	..	..	..	×	..	..	..	..	..	×	
" *Brodiæi* Grev.	..	..	..	×	..	..	..	..	..	..	
Pterosiphonia parasitica Falk. var. *repens* J. Ag.	×	..	..	..	×	..	..	..	..	..	
Brogniartella byssoides Bory	..	..	..	..	..	×	..	..	..	×	Risa Island.
Heterosiphonia plumosa Batt.	..	..	..	..	..	×	..	..	..	..	

LIST OF ALGÆ (*cont.*).

ALGÆ.	New to Orkney.	Above half-tide mark.	Half-tide mark.	Low tide.	6–11 feet.	16–20 feet.	32 feet.	40 feet.	72 feet.	Baltic.	SHORE LOCALITIES.
Trailliella intricata Batt.	×	..	..	×	×	×	×	×	..	..	
Griffithsia setacea Ag.	..	..	..	..	..	..	..	..	..	..	Risa Island.
Pleonosporium Borreri Näg.	..	..	..	..	×	..	..	..	..	..	
Rhodochorton Rothii Näg.	..	..	..	..	..	..	..	..	..	×	Green Head.
" ***floridulum*** Näg.	..	..	..	..	×	..	..	..	..	..	
Callithamnion byssoides Schm.	..	..	..	..	×	×	..	..	..	×	
" ***polyspermum*** Ag.	..	..	..	×	×	..	..	..	..	..	
" ***scopulorum*** Trail	..	..	..	..	..	..	..	..	..	..	Green Head.
" ***roseum*** Harv.	..	..	..	×	×	×	..	..	..	×	Green Head.
Compsothamnion gracillimum Schm.	×	..	..	..	×	..	..	..	..	..	
Plumaria elegans Schm.	..	..	..	×	×	..	..	..	..	..	Green Head, Risa Island.
Ptilota plumosa Ag.	..	..	..	..	×	..	..	..	..	..	Green Head, Risa Island.
Antithamnion Plumula Thur.	..	..	..	..	×	..	×	..	..	×	
" ***cruciatum*** Näg.	×	..	..	×	×	..	..	..	..	..	
Ceramium diaphanum Roth.	..	..	..	..	×	..	..	..	..	×	
" ***circinnatum*** J. Ag.	..	..	..	..	×	..	..	..	..	×	
" ***rubrum*** Ag.	..	..	..	×	..	..	..	..	..	×	Point of Cletts, Green Head, Risa I.
" ***acanthonotum*** Carm.	..	..	..	..	..	..	..	..	..	..	Green Head.
Dilsea edulis Stackh.	..	..	..	×	×	..	..	..	..	..	Point of Cletts, Risa Island.
Furcellaria fastigiata Lamour.	..	..	..	×	..	..	..	..	..	×	Risa Island.
Petrocelis cruenta J. Ag.	..	..	..	..	..	..	..	..	..	×	Green Head, Risa Island.
" ***Hennedyi*** Batt.	..	..	..	..	..	..	..	..	..	..	Green Head.
Hildenbrandtia sp.	..	..	..	..	..	..	..	..	..	..	Mill Bay.
Peyssonelia Dubyi Crn.	×	..	..	..	×	..	..	..	..	..	
Choreonema Thuretii Schm.	×	..	..	×	..	..	..	..	..	..	
Melobesia Lejolisii Rosenv.	..	..	..	×	..	..	..	..	..	..	Risa Island.
Lithophyllum pustulatum Fosl.											
var. ***Laminariæ*** Fosl.	..	..	..	..	..	..	..	..	..	×	Green Head.
" ***incrustans*** Phil.	..	..	..	..	..	..	..	..	..	..	Risa Island, Green Head.
Epilithon membranaceum Heydr.	..	..	..	..	..	×	..	..	..	..	Risa Island.
Corallina squamata Ellis	..	..	..	×	×	..	..	..	..	..	Risa I., Green Head, Point of Cletts.

CONDITION AND ZONATION OF THE WRECK FLORA.

The general sequence of algal zonation holds good with regard to the wrecks. As previously indicated, these lay on the west side of Scapa Flow, between the islands of Hoy and Cava, and their position is one of great shelter, where, despite the prevalence of high winds, the climate is moist and temperate. The wreck flora, which developed after the sinking of the German Fleet, possesses therefore many points in common with that of a rocky shore where sheltered conditions prevail.

A cursory glance revealed a distinct zonation of algæ occupying respective levels on the wrecks. Very few of the plants grew directly on the ships' surface, rusting iron providing an untrustworthy support. Barnacles, mussels, and even acidiellas afforded footholds for the primary growths of vegetation, which, in their turn, served as habitats for an epiphytic population; these, again, supporting a variety of microscopic species. This crowding of epiphytes was due possibly to the telescoping of the zones of vegetation on a vertical surface.

On certain wrecks—*e.g.*, on the 'Hindenburg' (when partially raised), the 'Seydlitz,' with 20 ft. above sea-level, and a partially submerged Destroyer in Risa Bay—there were large vertical surfaces exposed more or less within the wash of the tide. These were clothed with a green zone consisting of species of *Enteromorpha* and *Cladophora*.

The horizontal surfaces of the keels of the 'Moltke' and 'Kaiser' when exposed showed a mixed vegetation of tufted plants some directly on the ships themselves, but most on mussels attached to them. These surfaces proved more favourable than vertical ones, as is shown by the increased number of species found; on the 'Seydlitz,' within port-holes and gratings, shelter and shade fostered the growth of many red species, whereas outside at the same level the vertical sides of the ship bore a scanty vegetation.

The heavy belt of brown algæ grew in the following order from above downwards:—

I. A more or less continuous line of *Alaria* at the limit of low tide; the plants small and ill-developed.

II. Below this *Laminaria digitata* to a depth of about 6 to 11 ft. (In Risa Bay a few plants of *Saccorhiza bulbosa* mingled with the Laminarias were found on a partially submerged Destroyer.) The Laminarias nearer the surface had short broad laminæ widely divided. Each part of the plant had epiphytes, these attaining their maximum growth both in number and size about 8 ft. down. Such epiphytes as *Callithamnion byssoides, Ectocarpus confervoides,* etc., grew mostly on the upper surfaces of the *Laminaria* blades, probably as a result of better illumination. *Polysiphonia urceolata,* *Ptilota plumosa*, *Rhodymenia palmata*, and *Delesseria sinuosa* f. *lingulata* were found on the stipes; while handsome plants of *Odonthalia dentata*, *Dilsea edulis*, *Callophyllis laciniata* adorned the rhizoids.

III. Short and wide specimens of *Laminaria saccharina* replaced *L. digitata* at a depth of about 11 ft. The plants attained their maximum dimensions at a depth of 40 ft., where stalk and rhizoid measured 32 in. in length, laminæ 72 in. *Laminaria saccharina* and *Saccorhiza bulbosa* are the typical Laminarias of sheltered regions, and their prolific growths on the wrecks is in accordance with the characteristics of a sheltered flora. *Desmarestia aculeata* grew in any part of the brown belt, either epiphytically on the rhizoids of Laminarias or directly on the ships' sides. Plants varied in length, some measuring even 47 inches.

Encrusting algæ, such as *Lithoderma fatisceus*, grew over snail-shells etc., while *Ostreobium Quekettii* and *Conchocelis rosea* were found boring in the shells of barnacles. Beyond the belt of brown algæ at a depth of 72 ft. *Delesseria sinuosa* f. *lingulata* and *Rhodophyllis bifida* grew over *Ascidiella aspersa*. The plants were small and scarce. *Ostreobium Quekettii* occurred in barnacles. The algæ collected at 72 ft. agreed both in species and in habit (*i. e.*, creeping or boring) with those dredged by Hamel (**21**) from 100 ft. in the English Channel. Lack of light due to the curve of the ships' sides and overhanging Laminarias accounts partly for the paucity of algæ at the lower depths; the projections of the bilge-keels shut off all light from the flat bottoms of the ships.

As shown in the accompanying tables (pp. 236–240), the total number of species gathered from the wrecks at definite levels are as follows:—

At low-tide level sixty-four species; at 6–11 ft. lower the greatest number was eighty species. Below this a gradual decrease was noted. Seventeen species were gathered at 16–20 ft., nineteen at 32 ft., fourteen at 40 ft., till, finally, only six species were found at 72 ft. The high number of eighty is accounted for by the number of epiphytes. Summarizing the above, it will be seen that:—

1. Most of the vegetation ceased at 40 ft. from the surface, or at the bilge-keel.

2. Algæ did not grow on the wide flattened under surfaces of ships owing to absence of light and foothold.

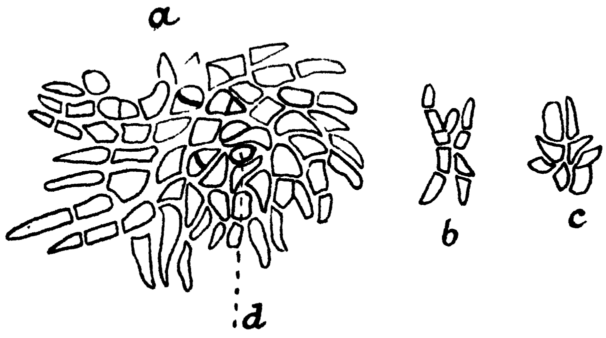
3. The number of species decreased with increased depths.

NOTES ON THE ADDITIONS TO THE MARINE FLORA OF ORKNEY.

PORPHYRIOPSIS COCCINEA Rosenv.—Numerous specimens grew over the Sertularias epiphytic on *Laminaria digitata* blades. Batters (6) included this plant in *Porphyra*, but later Rosenvinge (40) placed it in a new genus, *Porphyriopsis*. It differs from *Porphyra* in the chromatophore, which is flat, separated into portions, and without a pyrenoid. The reproduction, observed by Rosenvinge, is similar to that in *Erythrotrichia*—a curved division cuts off the round sporangium from a lunar-shaped sterile portion. Kirkwall is the only other Orkney locality from which this small and somewhat rare alga has been gathered.

ERYTHROCLADIA IRREGULARIS Rosenv.—This genus and species is new to Britain. It is known only from the Skagerak, where *E. irregularis* was found by Rosenvinge (40). The specimens were found on branches of *Cladophora rupestris* taken from the 'Moltke.' They are minute circular patches from 90μ to 100μ in diameter when fully grown. Growth is monostromatic and horizontal. A single cell divides, and filaments are given off in all directions, these again branch, the branching taking place behind the ultimate or penultimate cell (see text-fig. 1, *a*, *b*, *c*, *d*). Sporangia are formed in the centre. A crescent-shaped wall cuts off a portion of a cell in which a spore is formed. No pyrenoid was seen. The drawings are from material gathered in Scapa Flow.

TEXT-FIG. 1.

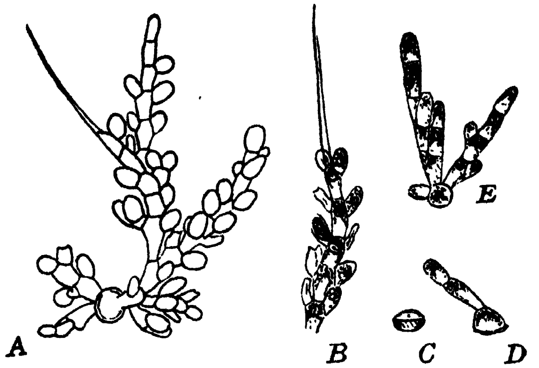


Erythrocladia irregularis Rosenv.

a, portion of a mature plant, × ca. 500; *b* and *c*, young plants, × ca. 500; *d*, sporangium.

CHANTRANSIA HALLANDICA Kylin var. PARVULA Rosenvinge (40).—This plant, new to Britain, was found by Rosenvinge in the S. Kattegat (text-fig. 2). The variety is extremely small and difficult to distinguish from

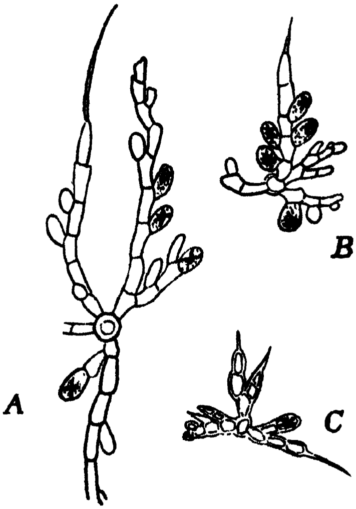
TEXT-FIG. 2.



Chantransia hallandica Kylin var. *parvula* Rosenv. from (**39**) fig. 26.

A, plant with sporangia; *B*, filament with partly-emptied sporangia; *C*, germinating spore; *D* & *E*, young plants, still sterile. × 300.

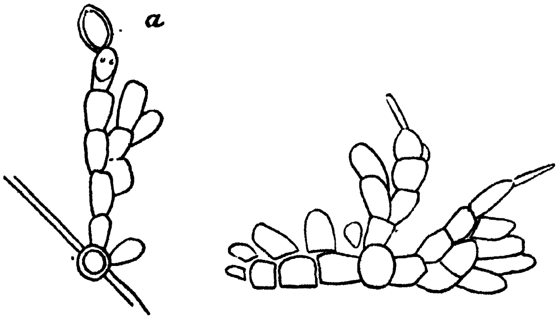
TEXT-FIG. 3.



Chantransia hallandica Kylin var. *parvula* Rosenv., from (**39**) fig. 24.

A, with long cells and alternate sporangia; *B*, with sporangia and antheridia; *C*, dwarfed plant with sporangium and sexual organs. × 390.

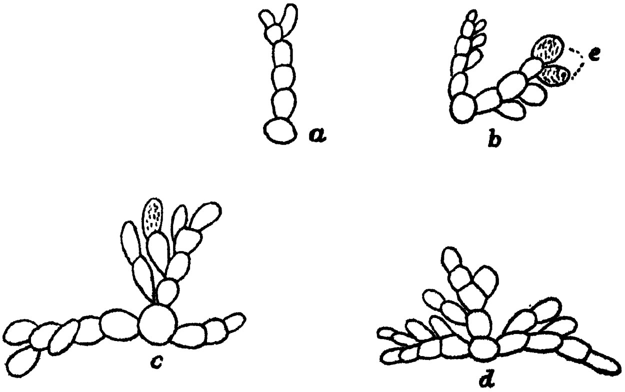
TEXT-FIG. 4.



Chantransia hallandica var. *parvula* Rosenv., × ca. 560, from Scapa Flow.

a, empty sporangium.

TEXT-FIG. 5.



Chantransia hallandica **Kylin var. *parvula* Rosenv.**

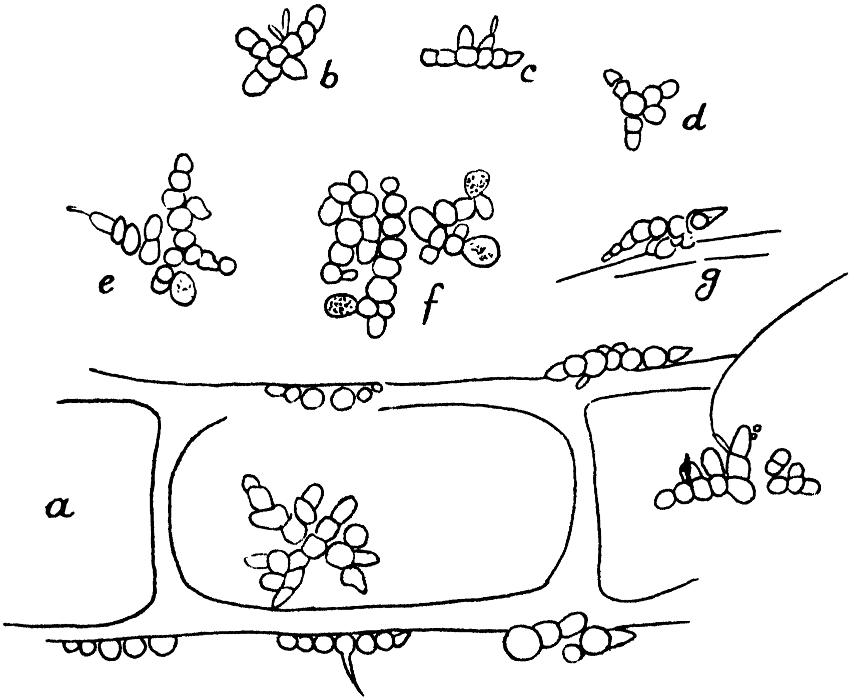
a, b, c, d, reduced plants at Scapa Flow; *e*, sporangia. × ca. 560

Kylinia scapæ which was also found on the same filaments of old *Cladophora rupestris*. Careful observation, however, reveals definite points of difference—*e.g.*, the erect habit, the budding out into sporangia of successive cells on a filament, the larger size of the plant and cells, and the stellate chromatophore.

Most of the plants found at Scapa Flow are distinctly reduced in size, and bear only sporangia. The drawings from the Scapa Flow plant (text-figs. 4 & 5) correspond very nearly with Rosenvinge's dwarf plant (text-fig. 3). They do not, however, taper at the extremities, nor do the sporangia occur opposite each other.

KYLINIA SCAPÆ, sp. n.—Cellula basalis sphærica fila plura, usque ad 4, horizontaliter emittens. Fila simplicia vel plus minus ramosa, ramis plerumque oppositis horizontaliter egredientibus. Cellulæ sphæricæ diametro ca. 4½–7 μ, chromatophorum ignotum. Fila nunquam pilo hyalino tenuissimo terminata. Sporangia terminalia vel lateralia, ovata ca. 11 μ × 9 μ.

TEXT-FIG. 6.



Kylinia scapæ, sp. n.

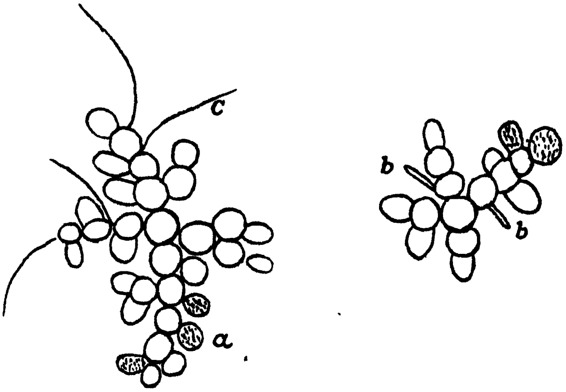
a, plants growing on filaments of *Cladophora*; *b*, *c*, *d*, & *e*, plants bearing androphores; *f*, plants bearing sporangia; *g*, sterile plant. × ca. 550.

Cellulæ androphoricæ ca. μ lat., longitudine variante ad apicem et dorsum cellularum vegetativarum, ut videtur, singulæ rarius binæ.

Cystocarps and antheridia doubtful.

Kylinia scapæ (text-figs. 6, 7) occurred on the branches of old *Cladophora rupestris* on the 'Moltke,' and on *C. gracilis* taken from the 'Seydlitz'; the material was preserved in 2 per cent. formalin and sea-water. It differs from Rosenvinge's species, *K. rosulata*, in the shape of the basal cell, which is spherical, that of *K. rosulata* being hemispherical. The cells of the filaments are also spherical and bead-like, while those of *K. rosulata* are longer than broad. The basal cell of *K. scapæ* gives off only one to four branches; those of *K. rosulata* may amount to seven.

TEXT-FIG. 7.



Kylinia scapæ, sp. n. × ca. 360.
a, sporangium; *b*, androphore; *c*, hair.

The alga branches out from a spherical basal cell in one to three or four directions. The globular cells of the branches measure ca. 4½–7 μ in diameter, and may again branch out in opposite directions. Their growth is horizontal, and sometimes extends round the filament; the colour is rosy red (text-fig. 6, *b*, *c*, *d*). Sporangia are ovoid, ca. 11 μ × 9 μ, either terminal or lateral and sessile, full of granular contents (text-figs. 6 *f* & 7). Colourless rod-shaped cells, called by Rosenvinge "androphores," measuring about 1 μ wide and of various lengths were seen, but antheridia and carpogonia were doubtful. *K. rosulata* Rosenv., the only other species of this genus, occurs in the North Kattegat.

EUTHORA CRISTATA J. Ag. was found on two of the wrecks. The specimens of this rare and northern species were small, possibly on account of the slightly lower degree of salinity on the west side of Scapa Flow.

PHYLLOPHORA TRAILLII Holm. & Batt. is another rare plant. One specimen was found on the 'Seydlitz,' another at Green Head on Hoy Island, both very small.

NITOPHYLLUM LACERATUM Grev. f. REPTANS Lyle was found growing over a barnacle, partly erect and partly prostrate. *Nitophyllum reptans* was formerly figured and described by Zanardini as a distinct species, and is an example of an initial stage of a plant receiving specific rank. Subsequently it was proved that this was the prostrate form of *N. laceratum* (28).

DELESSERIA SINUOSA Grev. var. LINGULATA Ag. is rare, but it was the form invariably taken from the wrecks, where it grew on the stipes of *Laminaria digitata.* The specimens found correspond with those from Skaill and Kirkwall in Batters's collection, but not with his variety *lingulata.* On the other hand, they agree with plants belonging to the variety from Kronborg in the Kattegat, and from Scandinavia, as seen among the specimens in the general collection at the British Museum (Natural History). The shore-form collected at Hoy Island was quite distinct; its fronds were divided into ovoid leaflets.

PTEROSIPHONIA PARASITICA Falk. var REPENS J. Ag.—Batters ranks this plant as a variety. In the present instance the same type of plant could be seen growing over mussel shells, partly erect and partly creeping. The creeping portions attached to the substratum by means of rhizoids are evidently initial stages or growth-forms of the species.

TRAILLIELLA INTRICATA Batt.—On all the wrecks that were examined this species was found epiphytic on the rhizoids of *Alaria* etc., from low tide down to a depth of 40 ft. This is the first record of the plant so far north; it is a habitant of the southern shores of England.

COMPSOTHAMNION GRACILLIMUM Schm. occurs in Scotland, but hitherto has not been recorded for Orkney, though *C. thuyoides* Schm. is listed for these islands.

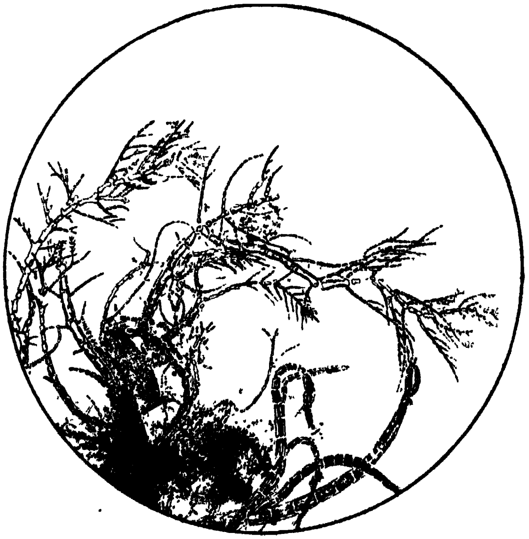
ANTITHAMNION PLUMULA Thur. (text-fig. 8).—Some of the specimens were difficult to identify ; there were no sporangia, and the stiff opposite arrangement of the branches suggested *Ptilothamnion.* A plant was found, however, bearing two upright branches, identical with the form in question, while the other branches were typical of *Antithamnion plumula.*

FUCUS CERANOIDES L. var. LINEARIS Batt.—Tufts of this variety were thrown ashore on Mill and Ore Bays. Where a burn entered the latter, there was plentiful growth along the muddy banks and over the stones. The attenuated stalky habit of the plant is probably an adaptation to its mud habit. The Loch of Stennis, Orkney, is the only other recorded habitat of this variety.

RALFSIA PUSILLA Batt. is new to this district and also extremely rare. It was taken from the stipes of *Laminaria digitata* along the shores of Risa Island and Green Head.

LAMINARIA INTERMEDIA Fosl. f. LONGIPES Fosl. (**14, 15**) is an addition to the Marine Flora of Britain. Whether it has been overlooked hitherto or has been introduced from the Norwegian coasts by some unknown means cannot be said. If introduced it may have come attached to ships, or with the cold current descending from the shores of Norway, or even by birds (7). An abundant growth of this form mingles with *Laminaria digitata* along the coast from North Ness to Green Head. Further investigation may reveal a wider distribution along the Orkney shores. The plant has a long flexible stalk and a large oval blade containing muciferous canals.

TEXT-FIG. 8.



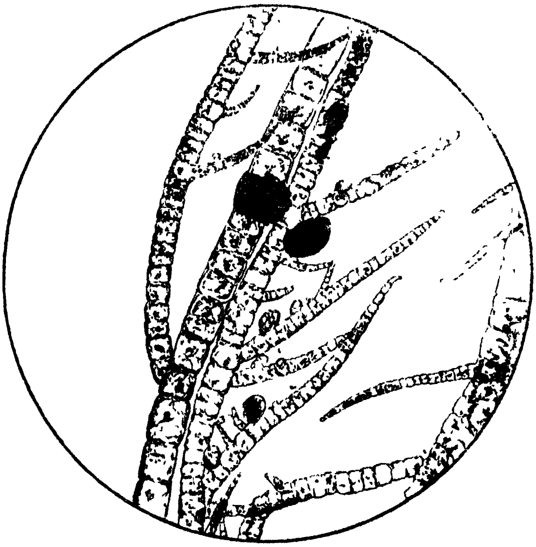
Antithamnion Plumula, × ca. 40. (Drawn from a photomicrograph.)
Branches showing stiff and abnormal growth-form.

ECTOCARPUS TERMINALIS Kütz. formed a velvet-like layer over the stipes of *Laminaria digitata*. In America a similar growth has been seen on the stipes of *Alaria fistulosa*, on the blades of *Egregia Menziesii*, and also on wooden piles.

ECTOCARPUS SANDRIANUS Zan. is rare and belongs to more southerly districts. Specimens have been listed from Bute and Ayr. The plant is closely related to *Ectocarpus virescens*, with which it has sometimes been confused, but the close secund arrangement of the small ovoid sessile sporangia and the pectinate character of the ultimate branches distinguish it.

ECTOCARPUS GRANULOSUS Ag. (text-fig. 9).—In addition to the ovoid, sessile, plurilocular sporangia, borne for the most part on the upper branches, there also occurred single intercalary unilocular sporangia within the branches. Since these are characteristic of the genus *Pylaiella*, where, however, they occur in chains, the question of their significance in *Ectocarpus* arises, for not only do they occur in *E. granulosus*, but also in other species of the same genus. Kuckuck considers *Ectocarpus* a further development of *Pylaiella* (25); they may possibly be vestigial, either the beginning or the end of a series of which *Isthmoplea* and *Kjellmannia* are intermediate stages between the truly intercalary and the apical positions of the sporangia.

TEXT-FIG. 9



Ectocarpus granulosus Ag., × 60. (Drawn from a photomicrograph.)
Portions of filaments with sessile and intercalary sporangia.

OSTREOBIUM QUEKETTII Born. & Flah., one of the boring Siphoneæ, is interesting, as its growth occurred at a depth of 72 ft., which was the limit of algal vegetation at the base of the wreck 'Moltke.'

HYELLA CÆSPITOSA Born. & Flah., a Myxophyte, and *Conchocelis rosea* Batt., a red alga, are found boring in shells, such as barnacles, mussels, and Flustræ. Doubtless, their presence has hitherto been overlooked in Orkney, as they are not uncommon. The last-named is possibly the same plant as *Ostreobium Quekettii*, which occasionally takes on a red colour (7).

CODIUM MUCRONATUM J. Ag. var. ATLANTICUM Cotton.—This alga occurs abundantly on the west coast of Ireland, where Cotton (8) first noted its appearance and added it to the Marine Flora of Europe. In giving the distribution Holmes has mentioned Iona, Scotland, Isle of Man, and Orkney among its habitats. There are specimens in Herb. Brit. Mus. from Orkney collected in 1891 and 1894. Only small specimens were found among the rhizoids of *Alaria* on the 'Moltke.'

MONOSTROMA FUSCUM Wittr. var. BLYTTII Batt.—The species has been recorded for Orkney, but not this variety, which, however, occurs in Scotland.

ORIGIN OF NOVELTIES, BRITISH AND FOREIGN.

As will be seen from the first column in the table (pp. 236–240) there are thirty-six additions to the flora of Orkney, including two genera, *Kylinia* and *Erythrocladia*, previously known only from the Baltic, the species of *Kylinia* being new to science. There are two other species new to Britain, the remaining thirty-two additions having been already recorded for Great Britain. It is difficult to generalize on the origin of these plants. The West Coast of Britain is more favourable to algæ and has been more intensively worked than the East Coast, but the absence of records does not necessarily mean that the plants are absent from the East Coast. For the majority of the species it is possibly better to regard their present range as having been extended.

Some of the British additions have not previously been collected so far north. They have probably travelled in the Gulf Stream and entered Scapa Flow *viâ* Hoy Sound, as they are abundant along the West Coast of Great Britain and Ireland. Some of the species grow indiscriminately on either coast, but a few are recorded only from the East Coast.

One of the foreign novelties was a Norwegian alga, *Laminaria intermedia* Fosl. var. *longipes*, found along the shores of Hoy and not on the wrecks. There are three Baltic species: *Kylinia scapæ*, sp. n., *Erythrocladia irregularis* Rosenv., recorded from the Skagerak, and *Chantransia hallandica* Kylin f. *parvula* Rosenv., from the S. Kattegat. Although the last two species have been recorded from the Baltic, they may occur elsewhere in Britain. All three are microscopic species, and the genera have been worked principally by Rosenvinge from Baltic waters.

Assuming that the three species are Baltic species which have recently reached the Orkneys, they may have been introduced either by currents or by the warships. They were epiphytic on two species of *Cladophora* common both to Britain and the Baltic, one of which, *C. rupestris*, is a perennial occurring in either saline or brackish water. Portions of *Cladophora* bearing the epiphytes may have been carried upon the vessels 'Seydlitz' and 'Moltke' from the Baltic to Scapa Flow. Small filamentous plants would either have escaped removal during cleaning operations or have become attached to the ships subsequently. They may have persisted for a time, while the epiphytes continued to grow and may have spread to other algæ. At the same time it might be urged that so far as is known the German Fleet came into Scapa Flow clean of growth ; and, quite apart from cleaning work, the red and white lead used on ships to prevent corrosion would tend to inhibit growth of all kinds.

The trend of the Atlantic Tidal Wave is from west to east into the North Sea. Some of this drift passes up the Skagerak and down the Kattegat into the Baltic Sea as a bottom saline current. There is no great movement in the opposite direction, though an upper current of low salinity from the Baltic passes out into the North Sea, where it circles round, and, mingling with other water, is dissipated and gradually lost (**24**).

There is, nevertheless, a northward movement of deep water along the east coasts of Britain (**24**), and it is possible that the algæ in question arrived by the latter devious route. The suggestion of direct transmission by warships, however, seems more feasible.

TYPES OF MARINE FLORA OF THE COAST.

Each of the two following types of coast-line has its characteristic marine flora :—(1) That of a rocky shore, as seen northward from Point of Cletts, and (2) that of low rock, sand, and mud, as described by Cotton (**8**), and which can be seen along the coast southwards from Point of Cletts to Longhope.

I. *THE VEGETATION OF THE ROCKY SHORE.*

This type is most strongly marked at Green Head, where zonation of the algæ can be observed along the face of the cliffs as if marked in streaks of colour by a gigantic brush. Lower seawards, where the shore is rough, the arrangement is broken and patchy.

A. *The Littoral Region.*

Beginning at the top of the cliffs and working downwards, the sequence of the Zones of Vegetation is as follows :—

1. A black belt of the lichen *Verrucaria maura* measuring about 2 ft. in depth along the face of the cliffs.

2. A large and dominant zone or "Association" of *Fucus*, composed

of several sub-associations, in the following order, distinguished by their respective colours :—

(a) *Pelvetia*, a yellowish-green belt about a foot or so deep.

(b) *Fucus spiralis*, orange-green along the cliffs, forming a band 2 or 3 ft. across.

(c) *Ascophyllum nodosum*, with its epiphyte *Polysiphonia fastigiata*, hangs long strap-like frons over the boulders in an olive-yellow band measuring 2 or 3 ft. in depth.

(d) *Fucus vesiculosus*, in dull green patches over the rocks.

(e) *Fucus serratus*, distinctly green though dark in shade, spreads itself out over the flat stones near low-water mark.

Plumaria elegans and *Cladophora rupestris* form a subsidiary or secondary association beneath that of *Fucus vesiculosus* (see 2 *d*). Here and there communities of *Chylocladia articulata*, *Delesseria alata*, and Polysiphonias mingle with this undergrowth.

Chondrus crispus and *Gigartina stellata* form another clearly marked secondary association beneath *Fucus serratus* (see 2 *e*).

The sub-associations of *Plumaria*, *Chondrus*, &c., are rather discontinuous, owing to the broken nature of the shore at their respective levels.

B. *The Sub-Littoral.*

1. The zone of Laminarias.—The shore ends at low-water mark on a platform or terrace covered with a heavy growth of *Laminaria*, constituting a dominant association composed of the following species :—

(a) *Laminaria digitata* mixed with

(b) *Laminaria intermedia* f. *longipes* ;

(c) *Laminaria saccharina* could be seen further out in deeper water. About 6 ft. seawards from the beginning of the *Laminaria* belt vegetation ceases, and the rocky floor is clean of growth. The water here is about 7–10 fathoms deep.

2. An association of encrusting algæ occurs in patches here and there over the rocks and stones at about low-tide level. Of this, the principal plant communities are those of :—(a) *Petrocelis cruenta*, (b) *Lithothamnion incrustans*, (c) *Lithoderma fatiscens*.

Cave Vegetation.—One cave was visited. Little direct sunlight penetrated, and local shelter was afforded by numerous boulders. The roof bore a velvety coating of *Callithamnion scopulorum*, *Rhodochorton Rothii*, and *Oscillatoria margaritifera*.

II. *THE VEGETATION OF LOW ROCKS, SAND, AND MUD.*

From Point of Cletts southward the Marine Flora becomes much modified and akin to that usually associated with sand, low rocks, and mud. The associations change—that of *Fucus*, though of wide extent, is no longer dominant, at least in its upper portions.

A. *The Littoral Region.*

1. *The Fucus Association Subdominant.*—This consists of:—

(a) *Pelvetia*, with the exception of a few plants in chinks of wall or causeway, is now almost absent owing to lack of suitable foothold at the right level, banks of earth having replaced the rocky cliffs.

(b) *Fucus spiralis* is poorly developed on account of the muddy and sandy nature of the shore, strewn with small stones.

(c) *Fucus vesiculosus.*—Below half-tide there is a fair development of this species, low rocks affording adequate anchorage for its growth.

(d) *Ascophyllum nodosum* appears along the lower littoral where a few hummocks of rocks protrude. This plant then takes the place of *Fucus vesiculosus*, which becomes subordinate and takes a lower level.

2. *Enteromorpha* and *Rhizoclonium* spp. form the dominant association along the upper littoral, showing as a green zone along the flat shore, and extending among the Fuci, where, as an undergrowth, it becomes a secondary vertical association. *Rhizoclonium* sp. is often rolled by the tide into long strands, which, when bleached by exposure, resemble portions of rope.

3. *Porphyra* is co-dominant with the previous association along the upper half of the littoral, and becomes dominant over the shore about the level of half-tide. *Porphyra umbilicalis* var. *laciniata* and *P. miniata* var. *abyssicola* grow attached to the stones and spread out over the beach, where their slippery fronds make walking difficult.

4. *Cladophora rupestris* is a secondary association extending in wide patches beneath *Fucus vesiculosus*, and mingling with *Cladostephus spongiosus*. It is a characteristic association of sand and mud where low rocks begin to appear.

5. Cyanophyceæ in a widely distributed belt spread over the littoral from above high-water mark down to low-tide level. It is composed of the following plant societies:—*Rivularia plicata* and *Isactis plana*, growing abundantly on muddy banks at the mouth of streams. *Lyngbya majuscula* mingling with *Rhizoclonium* sp. along the littoral, while *Rivularia àtra* grows over the stones down to the level of *Fucus vesiculosus*, covering them with little black dots. *Calothrix æruginea* and *Symploca hydnoides* are fairly common on the sides of muddy rocks.

B. *The Sub-littoral Region.*

An association of Laminariæ corresponds in species and arrangement with that of the more rocky shore, as previously described—the only addition being *Chorda filum.* Enormous plants of *Laminaria intermedia* f. *longipes* were thrown up along the beach, one frond measuring 49½ in. in length, and, with nearly the same width, formed a wide oval.

Comparison of Wreck Flora with that of Adjacent Shores.

A total of 167 species and varieties were collected from the wrecks and neighbouring shores. Forty-eight were common to both, 121 were found on the wrecks, but not on the shores of that particular locality; while forty grew exclusively on the shores.

Many species found on the shore were absent from the wrecks, as the level of the substratum afforded varies according to the depth of submergence. Thus growth was restricted for the most part to species belonging to low-tide level and beyond. In two cases only, where portions of vessels projected 20 ft. above the high water, their vertical surfaces, too windswept to support other vegetation, were clothed with a band of *Enteromorpha.*

Conditions of salinity, light, and aeration near the wrecks differ from those prevailing upon the shore. The percentage of salinity in the water surrounding the wrecks is 3·2—under the normal, though higher than in other localities near by. The presence of *Alaria*, *Codium mucronatum* var. *atlanticum*, etc., on the wrecks is doubtless accounted for by this fact, coupled with the decrease of shelter. The growth of brown algæ on the wrecks screened off much light, and in consequence certain red species were collected on them that were not found upon the shores in that district, viz., *Odonthalia dentata* etc. The flora on the wrecks was largely epiphytic.

The coast-line near the wrecks at Green Head is rocky and broken, and the vegetation saxicolous. Increased aeration of the water as a result of wave action, exposure to moist air, and alternations of light and shade from rocks and boulders, foster a flora somewhat different in character from that on the wrecks, e.g., *Gigartina mamillosa*, *Rhodochorton Rothii*, *Lithothamnion incrustans*, *Petrocelis cruenta*, *Callithamnion scopulorum*, etc.

In the brackish conditions of the bays between Longhope and Point of Cletts many species of Cyanophyceæ flourish, with *Fucus ceranoides* and its rare variety *linearis*, also *Dictyosiphon hippuroides* and *Chorda filum*—all species absent from the wrecks.

The absence from the wrecks of *Laminaria intermedia* v. *longipes*, abundant along the shores, cannot be explained, unless it be a matter of suitability of foothold.

Zonation of algæ found on the shore corresponded with that on the wrecks. Often, however, the composition of the zone differed.

SOME DIFFERENCES BETWEEN COAST AND WRECK FLORAS.

The species found on the wrecks were *Enteromorpha minima* and *E. compressa*, but those on the shore were *E. clathrata* and *E. intestinalis.*

The genus *Fucus* was represented by *F. vesiculosus* and *F. serratus* on the wrecks, whilst *F. spiralis*, *F. vesiculosus*, *F. serratus*, *F. ceranoides*, and *F. ceranoides* var. *linearis* belonged to the coast. *Chorda filum*, a sand and small-stone species, was restricted to the shores.

The Laminarias of the wrecks were *L. digitata*, *L. saccharina*, and *Saccorhiza bulbosa* ; those of the shore were *L. digitata*, *L. intermedia* var. *longipes*, and *L. saccharina.*

Rhodymenia palmata occurred on shores and wrecks, but the var. *sarniensis* was characteristic of the shore and var. *marginifera* of the wrecks.

Delesseria sinuosa was the normal habitant of the coast, while the var. *ligulata* seemed to be confined to the wrecks.

Of boring algæ *Hyella cæspitosa* and *Ostreobium Quekettii* were taken from the wrecks, but only *Gomontia polyrhiza* was found on the shores.

My best thanks are due to Dr. A. B. Rendle for obtaining permission to view the wrecks; to Miss A. Lorrain Smith and to Mr. A. Gepp, M.A., for their kind help and valuable advice in determining species, and for their constant interest in the investigations; to Prof. O. V. Darbishire, who placed at my disposal literature connected with the physical condition of the Baltic Sea, etc. I am also indebted to Messrs. Cox and Danks, the Salvage Contractors, for granting permission to examine the wrecks, and to Miss Cox, who kindly secured specimens from the 'Hindenburg.' Lastly, I wish to record my gratitude to Mr. David Wilson, whose boats I used on the expedition. The adaptation of the dredges for the special work on the wrecks was evolved and carried out by him, as was also the heavy work of manipulating the dredges and scraping the sides of the wrecks. Any success that has been achieved is largely due to his intelligent efforts and kindly help.

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The Taxonomy and Geography of the Sino-Himalayan Genus *Cremanthodium* Benth. By R. D'O. Good, M.A., F.L.S., Botanical Department, University College, Hull.

(Plates 9-13.)

[Read 19th April, 1928.]

I. TAXONOMY.

Introduction.

This revision of the genus *Cremanthodium* was undertaken with two objects in view—to classify and, if necessary, to describe the abundant material, especially that brought from China in recent years, and, by so doing, to provide a basis from which the distribution of the different species of this montane Asiatic endemic genus might be conveniently studied. For these reasons the revision is divided into two parts—taxonomic and geographic.

Considered in terms both of species-number and total range, the largest genus of the flowering plants is *Senecio*. Found in all parts of the world, and including an array of growth-forms and minor differential trends, it is not surprising that taxonomists have constantly essayed to subdivide it by the description of segregate genera. The value of these genera varies considerably and is purely a matter of opinion, but in practice some have received more recognition than others. Among the better known is the genus *Ligularia*. It is composed in general of tall robust herbs with very large, often reniform, leaves and many-headed long racemes or spreading corymbs of large and handsome capitula. The constituent proportions and other *minutiæ* of the capitula give them a facies which is quite distinct, but which it is difficult adequately to describe diagnostically. Distinct as is this type of plant from the more usual conception of *Senecio*, there are other species which are not so distinct, and which tend to grade imperceptibly into typical *Senecio*, this being especially marked in the corymbose species, and it is very difficult to make a satisfactory generic description for *Ligularia*. Nevertheless, these species, phylogenetically, represent a trend from *Senecio* in the direction of increased general size, increase of leaf size, and development of radical at the expense of cauline leaves, racemose inflorescences, and various small features in the heads themselves. Moreover, they are geographically segregated, being almost entirely confined to warm temperate

Eastern Asia, only one or two species extending westwards to Europe and northwards into Siberia. Their area is thus largely within the temperate eastern monsoon region, and hence *Ligularia* may well be characterized as reflecting the climatic peculiarities of that zone and comprising the East Asiatic warm temperate high rainfall derivatives of *Senecio*.

Within the geographical area of *Ligularia* lies a great part of the vast Asiatic mountain system with its widespread zones of alpine vegetation. Above certain altitudes in these mountains, the height varying with latitude, but in general about 12,000 ft., are found a number of Composite species obviously resembling *Ligularia*, but much reduced in size and very often with only a single nodding head. The heads are usually large and frequently have a peculiarly pleasing musk-like fragrance (a feature present also in certain species of *Senecio* from other parts of the world), which persists to an astonishing degree in the dried plants. Such a species was made the basis for the genus *Cremanthodium*. This genus bears to *Ligularia* almost exactly the same relationship that *Ligularia* bears to *Senecio*. There is no absolutely diagnostic character to separate them, but the great bulk of species are distinguishable at sight. The species of *Cremanthodium* represent, in fact, the high-alpine derivatives of *Ligularia*.

This prologue is necessary in order to explain a great difficulty which at once confronts the worker at these particular groups—namely, the difficulty of defining the genera. As regards *Cremanthodium*, it became a question whether the genus should be maintained or sunk, and this, by analogy, would involve the sinking of *Ligularia*. The alternative to such a procedure must be to remodel *Cremanthodium* in such a way as is most consistent with known facts. The argument for reduction is the difficulty of diagnosis and consequent difficulty of generically identifying individual specimens. The arguments against reduction are, first, that any subdivision, on reasonable grounds, of such an unwieldy unit as *Senecio* is desirable, and, second (and more important), that reduction would obscure the existence of this very well-marked ecological, geographical, and phylogenetic group of species. In the following pages the second course has been adopted, and the genus *Cremanthodium* has been enlarged so as to include all the high-alpine species which can reasonably be considered as derivatives of *Ligularia*.

HISTORICAL.—The genus *Ligularia*, with which the story of *Cremanthodium* begins, has had a somewhat unusual history. It was described, if such a term is applicable, by Cassini in 1816 with the words: "This genus, of the tribe of the Adenostyleæ, has as its type *Cineraria sibirica* L., and it differs from the three other genera known at present in the tribe, in that the head is radiate." It is difficult to see how the close affinity with *Senecio* came to be overlooked, but it was realized by Lessing, who, in his 'Synopsis

Genera Compositarum' of 1832, placed it in the Senecioneæ. As a result of this change of position, the original description of the genus becomes meaningless, and many subsequent authors have redescribed it without any great success. Since Lessing's time the genus has remained in varying close proximity to *Senecio.*

The genus *Cremanthodium* was founded by Bentham on a species from the Sikkim Himalaya already tentatively described by De Candolle in the 'Prodromus' as a *Ligularia.* Two other species were described at the same time and all three illustrated. It is not easy from Bentham's writings to see exactly on what he based the genus or what he considered the diagnostic characters, but these appear to be the nodding and solitary heads, while the styles and anthers are also described in detail. Later workers have taken widely different views of the genus. Bentham and Hooker in their 'Genera Plantarum' maintain it, but place it in the Tussilagineæ next to *Homogyne.* This genus has three species in the European Alps, and in facies closely resembles a *Cremanthodium* with erect discoid heads. The suggestion that there is a real affinity between the two is attractive, but *Homogyne* has one or two structural points of distinction, such as tubular female radial florets. Besides this all the indications make it much more likely that *Homogyne* is a derivative of *Tussilago,* or *vice versâ,* and that it has no immediate relation with *Senecio.* Since the 'Genera Plantarum' the two have been kept separated in two distinct subtribes. That they were ever associated seems to have been due to the use of unreliable characters, a subject which will be referred to again below.

In 1892 Franchet published in the 'Bulletin de la Société botanique de France,' a paper entitled "Les genres *Ligularia, Senecillis, Cremanthodium* et leurs espèces dans l'Asie centrale et orientale." Here all the available knowledge of the groups was brought together, and the result was a most useful piece of work, but he reduced *Ligularia* to a group of *Senecio,* and *Cremanthodium* and *Eu-Ligularia* to sections of this group. His distribution of species between these two sections is perhaps the weakest part of his work. More recently Hoffmann, in the 'Pflanzenfamilien,' has kept up *Cremanthodium* and *Ligularia,* placing them next to *Senecio* itself, an arrangement which exactly expresses the conclusions reached in the Introduction above.

Generic Characters.—Having decided to maintain the genus *Cremanthodium,* it was necessary to emend the original description and enlarge its scope in accordance with the phylogenetic conception suggested above. A preliminary examination of the material showed that two at least of the Benthamian characters, solitary capitula and cernuous capitula, were of no value. Even the species most commonly with only a single head sometimes have more than one, and these may be arranged regularly or irregularly.

Conversely, several instances are known where several- or many-headed species sometimes have forms with solitary heads. The character of nodding is really one of degree only: most of the species nod to the extent of the genotype, but a number of others show every stage between this and completely erect heads. It may be mentioned that both types occur in *Ligularia*, racemose species in general being cernuous and corymbose species erect.

It is well known that in the Compositæ very minute characters are often found necessary for diagnosis. These are of two main kinds—the shape of the anthers and the shape and sculpturing of the style-arms. The former hardly concerns the genus, as it is used chiefly as a tribal or subtribal diagnosis, but the latter is used both for genera and species. A very careful examination of the styles of all the species of *Cremanthodium* was made, and the conclusion was reached that no useful purpose would be served by attempting to base any generic differences upon them. It is true that certain distinctions can with good luck be made out, but these appear to have no relation to other characters. The differences are mainly due to variation in age, and should therefore be used with the greatest caution. Conspicuous and important variations in the anthers or styles were absent, and these features are not made use of in the generic description. Previous attempts to make use of them have invariably ended in increased confusion.

Every endeavour was made to find some other definite structural character which might serve to separate *Ligularia* and *Cremanthodium*, but none was found; nor was this surprising, since the genus is essentially an ecological one. One or two partially diagnostic characters emerged, such as proportions of the disc-florets, pappus, and phyllaries, which separates certain racemose species of *Cremanthodium* from small examples of similar species of *Ligularia*; but these were rare. Neither was it possible to use ecological, geographical, or altitudinal features to any extent. As a result of this the final emended generic description given below contains no absolute structural diagnostic character. On the other hand, it ensures that the high alpine Asiatic derivatives of *Ligularia* shall remain grouped together in the phylogenetic and ecological genus *Cremanthodium*.

The weakest point in the generic description is the failure to define more accurately the number of capitula in the genus; but in actual practice this does not cause very much difficulty. In only two species is there any anomaly. This is in *C. pleurocaule* and *C. plantaginifolium*—species which normally have a small raceme with some 10–12 heads upon it, quite comparable with other species. Both have, however, very luxuriant forms in which the total size of the plant is much greater and the number of heads very large. These forms closely resemble certain species of *Ligularia*, such as *L. melanocephala* Franch., both in stature and in head-number; yet their relation with the species is obvious, and they must be included in the genus *Cremanthodium*.

SPECIFIC CHARACTERS.—The difficulty of diagnosis is not confined to the genera, but is equally marked in the species, and the whole group of plants, including both *Cremanthodium* and *Ligularia*, seems to be in a particularly fluid condition. *Cremanthodium Hookeri* is perhaps the most difficult species. It is a very common and often collected plant, and it has been necessary below to classify it into two subspecies and five forms ; but even this is not entirely adequate. It is on the whole very close to some species of *Ligularia*, and undoubtedly forms one of the chief connecting-links between the two genera. It is presumably a reduction from a racemose *Ligularia*, but the reduction has apparently proceeded in two directions, always with reduction in size, but accompanied, on the one hand, by reduction in the number but not the size of head, and, on the other hand, in reduction in size but not in number. Besides this, there seems to be some slight evidence of secondary multiplication of heads from a single- or few-headed form.

Another feature of the genus is the number of unique specimens in it—namely, forms which have been collected once only and sometimes represented by only a single plant. The more conspicuous of these have been described as species and the less conspicuous as lesser categories, but there remain a number best dealt with by placing them tentatively under the nearest described species as anomalous specimens. This has been done in particular where the limits of the described species are inaccurately known. Until a form has been collected more than once in the same locality there is no real evidence that it persists for more than one generation. Some of the specimens indicate a hybrid origin.

The question of species production will be discussed more fully in the geographical part of the paper, but the features just described, the difficulty of diagnosis and the amount of variation, suggests that the group is a young one still in process of complete differentiation from a parent group, and one in which variation in one or more definite directions has not become fixed. Associated with this is the absence of the divergent effect of geographical segregation within the genus.

In order to facilitate comparison between the species, each is described in the same standardized form, and the predominant features of the eight most important parts of the plant are given. These parts are the stem, the radical leaves, the cauline leaves, the capitula, the phyllaries, the disc florets, the ligulate florets, and the pappus. Both roots and achenes are omitted because they are rarely collected in a complete or ripe condition. This short English description is diagnostic and only the differential characters are given. In the new species a complete Latin description is appended as a footnote, and measurements are embodied in it.

The stem is the flowering axis because, throughout the genus, the cauline leaves are always more or less reduced to bracts. It is normally glabrous below and with some sort of indumentum above. Most commonly this takes the form of a very loose white cobweb tomentum, but sometimes this is slightly modified. A closer tomentum is only rarely seen. In some species the stem is more or less covered with multicellular black glandular hairs. When these are dry the cells and their contents shrivel and the hairs have the appearance of short strings of black beads. Sometimes two or more of these types are found in combination, as, for example, a mixture of white cobweb and black hairs. A dark steel-grey wool occurs in *C. plantagineum*, while *C. Helianthus* and *C. suave* are entirely glabrous and somewhat glaucous. In section the stem is usually terete-striate. A general average stem-height is given below for each species, but it must be remembered that there is very great variation in this character and that dwarf individuals often occur.

The radical leaves are of two quite distinct kinds about equally represented. The first has long petioles and roundly or cordately reniform laminæ. This type is surprisingly constant. Such leaves are usually glabrous, but rarely tomentose below. It is this type of foliage which, associated with the single cernuous heads, gives many species of the genus their characteristic facies. This shape resembles that of many Ligularias, but is scarcely known in *Senecio*. In the other type the leaves are variations on the lanceolate cuneate plan, usually with short or no petioles. Some of them are almost truncate below, but this is rare, and the two extreme conditions are a spade shape on the one hand and a very narrow ligulate linear on the other. Both types of leaves are normally dentate, but some of the latter kind are almost or quite entire. Three species are rather anomalous in their leaves—*C. pinnatifidum* with pinnatisect leaves, *C. palmatum* subsp. *Benthami* with palmatisect leaves, and *C. Forrestii* with deltoid hastate subentire leaves. The petioles of the reniform leaves are commonly vaginate below, and this character is sometimes seen in the other type as well. The base of the petioles may be surrounded by a ring of fibres representing the remains of earlier petioles or those of previous years.

The cauline leaves provide several characters of value. They are nearly always reduced editions of the radical leaves, but the method of reduction varies. Sometimes the vaginæ only are left, in others the vaginæ disappear. In the extreme they are reduced to a simple bract-like structure. Sometimes they are numerous and large so as to touch or overlap, thus almost covering the stem.

The characters used for the capitula require a little definition. It has been already stated that they may be cernuous, semi-cernuous, or rarely erect. Their shape is described in three ways (see Pl. **10**): suburceolate when the head has the elevation of a barrel, the phyllaries slightly convex outside and the ligules slightly incurved at the tip; hemispherical when the phyllaries are spread, but still convex or slightly incurved at the tip, and the ligules are spreading; and campanulate when the base of the capitulum is narrow, the phyllaries are concave or with slightly spreading tips, and the ligules completely spreading or recurved. Intermediate conditions occur. Measurements of diameters include the ligules. The capitula may be either ligulate or discoid, and this character is very constant. At the same time, one or two rare examples indicate that a species may have both kinds of heads, and so this difference is not emphasized as a specific character.

The important differential features of the phyllaries are the colour when dry, the covering, and the shape of the apex. They are always one-seriate, but are irregularly imbricate. The presence of one or more small bracteoles at the base of the capitulum is not of great taxonomic importance.

The size of the capitula varies enormously even in one and the same species. Below they are described as (1) small, (2) medium, or (3) large, these expressions corresponding roughly to average diameters of (1) less than 4 cm., (2) between 4 and 6 cm., (3) above 6 cm.

The corollæ of the disc-florets show considerable differences and important specific characters. In practically all species they have a very fine tubular lower part and an upper part of much wider bore. This upper part may be cylindrical, subcampanulate, or truly campanulate. Very rarely the distinction between the upper and lower parts is absent, and the whole corolla is uniformly narrow funnel-shaped. In the descriptions below, the proportions of the parts are shown by expressing the upper part as a fraction of the whole, the lower part being represented by the remainder.

The ligulate corollas show most variation in the shape of the ligules and the length of the tubular portion. The shape of the ligule is usually elliptic, equally cuneate at both ends, or very long and gradually tapering broader at base, or obcuneate broadest above. Most intermediate conditions are to be found. The tubular part may be well marked, but is rarely quite absent. It is most often about 1/6 the length of ligule. Some variation is seen in the apical teeth. They are frequently minute and triangular, but are sometimes much longer and almost laciniate.

The pappus is barbellate and constant in form throughout the genus, except in one species in which it is absent and in one where it is very short. The colour varies from white to dull bronze, most often the former.

Only in the new species has any attempt been made to describe the achenes, because they are nearly always collected unripe.

After the diagnostic descriptions, there is given the ecological habitat and altitude. This is compiled from the available information on the collector's labels, but only too often there is no information given. On the other hand, the recent collectors in China give the fullest notes, so full that it is impossible to reproduce them *in extenso*. Next is given shortly the geographical range as it is known at present, and following this is a register of specimens arranged according to the major territorial divisions in which they have been found. These divisions are indicated by initials according to the following scheme:—

W.H. = Western Himalaya.
N. = Nipal.
Sk. = Sikkim.
Bh. = Bhutan.
B. = Burma.
T. = S.E. Tibet.
S.T. = Southern Tibet.
Y. = Yunnan.
S. = Szechuan.
K. = Kansu.

Any others are written in full.

It has not been thought necessary to indicate the herbaria of the different specimens. Those collected by Handel-Mazzetti are in the Natural History Museum at Vienna, with a few duplicates at Edinburgh and Kew. The great bulk of the remainder are at Edinburgh, Kew, or the British Museum, mostly at the first, where there is a complete set of the recent Chinese collectings. The very few remaining unrepresented in this country are in Paris, Berlin, or Calcutta.

It is a matter for regret that it has not been possible to include in the enumeration the specimens collected by Prof. Harry Smith, of Uppsala. These are at present in the hands of Dr. Mattfeld, who has not seen his way clear to accede to my request for their loan, and it has therefore been necessary to omit them.

In the classification of the genus three intrageneric categories have been used, and the conceptions under which they have been employed must be shortly explained. Bearing in mind the primary purpose of a revision—namely, to classify and place the various units in their most probable relation to one another,—it is clear that the use of only one category does not enable this to be done to the best advantage. On the other hand, a too great multiplicity of categories defeats, by its own complexity, its main object. After careful consideration it was felt that three categories would meet the case to the best advantage. The three selected were the *species*, the *subspecies*, and the *form*. The conception of the species as used here is a comparatively wide one, as is necessary when two subsidiary categories are used. It is also used as of indefinite values, no two of which need be exactly comparable, but all of which fall within certain definite limits. In other words, the species are not necessarily to be considered as equivalent taxonomic units, but only as units intermediate in size between the subspecies and the genus. The subspecies has been used because of its obvious name and meaning, and has been employed in the sense of incipient evolutionary species—namely, units differing in certain definite features, but on the whole with too much general resemblance to be treated as species. It is also used where distinct extremes are united by a complete series of intermediates. The third category is the form. This, again, as its name implies, is a mere subsidiary unit employed when it became necessary to recognize minor structural or geographical features without definite commitment as to their phylogenetic or hereditable value. Forms may, of course, rank as incipient species, but, on the other hand, their designation by that term does not involve the assumption that they are necessarily more than non-inherited ecads or variations. The category of the variety has not been used at all because, in the writer's opinion, it is not a convenient botanical term. Its actual verbal meaning carries with it nothing more than a difference such as may be met between individuals of the same species. If it is used in the same sense as a subspecies, then that latter term is infinitely preferable as expressing exactly what it denotes. Finally, the conception of the variety is by now seriously vitiated by its use in horticulture for colour and teratological forms of one and the same species and its close association with highly cultivated strains which would not in Nature be permanent.

CREMANTHODIUM Bentham emend. R. Good.

Cremanthodium Bentham in Hk. Ic. Pl. t. 1141, 1142 (1873); Bentham & Hook. f. in Genera Plantarum, ii, i, 439 (1873); Hook. fil. in Flor. Brit. Ind. iii, 330 (1881); Clarke in Comp. Ind. 166 (1876); Hemsley in Index Pl. Sinenses, i, 447 (1888); Hofmann in Pflanzenfamilien, iv, 5, 301 (1894).

Senecio subsect. *Cremanthodium* Franch., in Bull. Soc. Bot. Fr. xxxix, 279 (1892).

Medium to dwarf *high-alpine herbs* of the *Tibetan–Indian–Chinese mountain system*; leaves mostly radical, often *reniform*; cauline leaves more or less bracteiform; heads *large and solitary* or *few in a simple raceme or corymb*, nearly always *cernuous* very rarely erect and then solitary, ligulate or discoid, often *fragrant*, with a facies of *Ligularia*; *upper portion of disc-corolla never completely exserted from both phyllaries and pappus*, all three usually about the same length; floral structure otherwise that of *Senecio*.

CLAVIS OF SPECIES.

A. Phyllaries with an outer involucre of larger, broad, green bracts.
Leaves ovate elliptic .... 39. *Helianthus.*
Leaves linear elliptic spathulate........................... 40. *suave.*
AA. Phyllaries without an outer involucre of bracts.
B. Heads discoid.
Phyllaries petaloid.
Phyllaries usually hairy all over, less than twice the length of the disc-florets .... 2. *campanulatum.*
Phyllaries hairy towards the base only, more than twice the length of the disc-florets .... 1. *Wardii.*
Phyllaries not petaloid.
Leaves reniform or cordate.
Heads racemose, leaves usually acute .... 16. *Hookeri* forma.

Heads solitary or cymose, leaves rounded.
Heads usually solitary.
Phyllaries entire, leaf venation inconspicuous below .... 17. *calcicola.*
Phyllaries fimbriate lacerate, venation conspicuous .... 18. *atrocapitatum.*
Heads small and cymosely arranged .... 19. *microcephalum.*
Leaves not reniform.
Leaves narrow linear spathulate .... 41. *angustifolium.*
Leaves ovate to narrow oblong, truncate below .... 43. *discoideum.*
Leaves roundly hastate, plant black hairy .... 27. *atroviolaceum.*
BB. Heads ligulate.
C. Leaves hastate .... 26. *Forrestii.*
CC. Leaves otherwise. [*Benthami.*
Leaves palmatisect .... 3. *palmatum* subsp.
Leaves otherwise.
Leaves pinnatisect .... 42. *pinnatifidum.*
Leaves entire or toothed.
D. Leaves reniform or cordate.
Cauline leaves bulbilliferous .... 4. *bulbilliferum.*
Cauline leaves otherwise.
Leaves loosely araneose below; flowers white, fading purple (see also *citriflorum*) .... 10. *Farreri.*
Leaves closely tomentose below .... 9. *Decaisnei.*
Leaves glabrous or subglabrous below.
Venation more prominent on the upper side of the leaf .... 8. *Smithianum.*
Venation more prominent on the lower side of the leaf.
Heads erect .... 23. *acernuum.*
Heads cernuous.
Leaves less than 3 cm. in diam., with few crenate teeth .... 22. *cyclaminanthum.*
Leaves usually more than 3 cm. in diam., regularly and acutely dentate.
Pappus very short, purplish .... 15. *phœnicochætum.*
Pappus white or bronze.
Tube of ligulate floret obsolete, heads large .... 12. *reniforme.*
Tube of ligulate floret present.
Phyllaries brown, glandular, pubescent; heads usually corybose .. 14. *cremanthodioides.*
Phyllaries glabrous or subglabrous; heads not corymbose.
Heads small, solitary or racemose, campanulate if solitary; leaves often pointed .... 16. *Hookeri.*
Heads moderate to large, hemispherical, never in a close raceme.
Ligules obcuneate rounded, [*rhodocephalum.*
teeth obscure .... 3. *palmatum* subsp.

Ligules otherwise
Ligules lanceolate and long tapering ....
Disc-florets short and broadly campanulate . 7. *pulchrum.*
Disc-florets long and subcylindric campanulate. 11. *citriflorum.*
Ligules otherwise.
Leaves truly reniform with palmate venation.
Small slender plants with leaves up to 4 cm. across.
Habit very slender, ligules red ...... 6. *gracillimum.*
Habit stouter, ligules yellow .... 5. *Thomsoni.*
Large stout plants, leaves very large .... 13. *retusum.*
Leaves subquadrate cordate, venation subpinnate.
Leaves glabrous below . 21. *gypsophilum.*
Leaves rufescent woolly below .... 20. *Principis.*
DD. Leaves not reniform or truly cordate.
E. Leaves truncate or nearly so below.
F. Leaves regularly and acutely dentate.
Cauline leaves few, not touching or overlapping.
Leaves oblong, usually over 15 cm. in length.
Heads solitary or very few loosely arranged, not white-woolly .... 31. *arnicoides.*
Heads in a dense regular white-woolly raceme. 32. *rumicifolium.*
Leaves spade-shaped, much less than 15 cm. in length................................ 28. *Delavayi.*
Cauline leaves several, touching or overlapping.
Cauline leaves dentate, narrowed below ...... 30. *sino-oblongatum.*
Cauline leaves entire, broader below.......... 29. *oblongatum.*
FF. Leaves entire or shallowly dentate.
Ligules very narrow strap-shaped; leaves very small .... 24. *Potanini.*
Ligules lanceolate, long tapering; leaves medium-sized.
Phyllaries white-arachnose .... 25. *Prattii.*
Phyllaries quite glabrous .... 44. *pseudo-oblongatum.*
EE. Leaves gradually narrowed below into the petiole.
F. Leaves glabrous on both sides.
Heads cernuous, medium-sized herbs.
Leaves distinctly petiolate.
Cauline leaves several touching .... 46. *variifolium.*

Cauline leaf single .... 45. *bupleurifolium.*
Leaves not distinctly petiolate.
Phyllaries velvety, with several outer broad scarious bracts .... 38. *stenactium.*
Phyllaries without outer scarious bracts.
Leaves very narrow linear .... 34. *lineare.*
Leaves oblanceolate to broad elliptic.
Phyllaries steel-grey lanate .... 37. *plantagineum.*
Phyllaries not lanate.
Stems black-hairy, heads solitary .. 36. *nobile.*
Stems not black-hairy, heads usually racemose.
Venation pinnate .... 35. *plantaginifolium.*
Venation parallel .... 33. *pleurocaule.*
Heads erect, a very dwarf herb .... 48. *nanum.*
FF. Leaves lanate on one side .... 47. *humile.*

1. C. WARDII W. W. Sm. in Notes Roy. Bot. Gard. Edin. x (1917), 27.

Stem glabrous below, lanate hairy above, up to 25 cm. *Radical leaves* long petiolate reniform dentate, glabrous, very pale, with conspicuous venation below. *Cauline leaves* petiolate, reniform to linear, not vaginate. *Capitula* solitary in all specimens seen, medium, suburceolate. *Phyllaries* white to purple-veined or purple-flushed, obcuneate, mucronate, not fringed, scattered hairy below the middle. *Disc-florets* white to dark purple, less than half the length of the phyllaries, upper 2/3 campanulate. *Ligulate florets* none. *Pappus* short and white.

Habitat : Cliffs, screes, and ledges ; stony pastures and meadows ; in moss and mud on granite rocks and boulders, 11,000–14,000 ft.

Range : Extreme N.E. Burma.

B.: *Forrest* 24947, 25019, 26819, 27005, 27253, 27295 ; *Kingdon Ward* 1796 (type), 3360 ; *Farrer* 1177.

Very close to *C. campanulatum* and apparently the representative of that species on the granite rocks of N.E. Burma. The statement in the original description, "ex affinitate *Cremanthodii discoidei*," is misleading, as will be evident from the clavis, the only point of resemblance being the absence of ligulate florets.

2. C. CAMPANULATUM (Franch.), Diels in Notes Roy. Bot. Gard. Edin. v (1912), 190.

Senecio campanulatus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 284.
Cremanthodium Larium Hand.-Mazz. in Anz. Akad. Wiss. Wien. Math.-Nat. lxii (1925), no. 2.

Stem glabrous below, lanate hairy above, up to 40 cm. *Radical leaves* long petiolate reniform dentate, pale green with purple veins or *vice versâ* below, glabrous except for a few hairs (mostly on the petiole). *Cauline* *leaves* petiolate, reniform to linear, not vaginate. *Capitula* solitary in all specimens seen, large, suburceolate. *Phyllaries* white to black-purple, obcuneate, fringed at the tip and more or less covered with dark purple hairs. *Disc-florets* purple, more than half the length of the phyllaries, upper 4/5 long cylindrical. *Ligulate florets* none. *Pappus* white.

Habitat : Crevices and ledges of limestone ridges and cliffs, stony alpine meadows and pastures, and limestone screes ; rare on granitic gravel, 11,000–15,000 ft.

Range : Extreme S.E. Tibet, extreme S.W. Szechuan and extreme N.W. Yunnan.

T. : *Forrest* 14375, 19256 (very large), 19281, 20061.

S. : *Kingdon Ward* 4417 ; *Handel-Mazzetti* 7416 ; *Wilson* 3812 ; *Hosie*, s. n.

Y. : *Forrest* 465, 2751, 6597, 10793, 10806 (green), 12709, 14543, 17391, 22254, 25712, 25888 ; *Kingdon Ward* 1036, 1037 ; *Handel-Mazzetti* 3636, 3637, 4530, 6900, 8127 (type of *C. Larium*) ; *Rock* 4643, 5726, 7760, 9732, 9888, 9898, 9966 ; *Schneider* 1958, 2258, 2394 ; *Delavay* 2192, s. n. (type).

Varies considerably in size and colour, especially that of the phyllaries. *C. Larium* is simply a very luxuriant form growing in granitic gravel, and there are all intermediates between it and the more normal type. The leaves are sometimes doubly serrate.

3. C. PALMATUM Benth. in Hook. Icones Plant. xvii (1887), 1142.

Stem glabrous below, purple hairy above, with multicellular hairs, up to 25 cm. *Radical leaves* long petiolate, roundly reniform, with few large mucronate teeth, or palmately divided as far as the centre, glabrous above except for a few scattered hairs on the surface and edge, purple below with a few scattered hairs. *Cauline leaves* reniforn to linear, petiolate and without vaginæ. *Capitula* large, campanulate, usually solitary but rarely 2–3 on the same flowering stem. *Phyllaries* lanceolate, acute, purple pubescent, about 15 mm. long. *Disc-florets* rosy purple or crimson, rarely white, upper 3/4 subcylindric campanulate. *Ligulate florets* rose-pink, rarely white, tube very short, ligule obcuneate, rounded or truncate. *Pappus* white.

Subspecies BENTHAMI R. Good, subsp. nov. Foliis palmatifidis. *Senecio Benthamianus* Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 286.

Subspecies RHODOCEPHALUM (Diels) R. Good, comb. nov. Foliis dentatis, *Cremanthodium rhodocephalum* Diels in Notes Roy. Bot. Gard. Edin. v (1912), 190.

Habitat : Screes, drifts, moist crevices of limestone cliffs ; stony meadows ; earth slopes ; grassy downs and glacier-lake mud, 11,000–16,000 ft, *Range*: Subsp. BENTHAMI is found in Sikkim and neighbouring Tibet and Bhutan; subsp. RHODOCEPHALUM in extreme N.E. Burma, N.W. Yunnan, S.W. Szechuan, and S.E. Tibet.

Subsp. BENTHAMI.

Sk.: *Lepcha* 1027, 2898; *Smith* & *Cave* 1771, 1691, 2081, 2501; *Cooper* 405; *Hooker*, s. n. (type of species); *Gammie* 411, s. n.; King's coll. s. n.; *Dungboo*, s. n.

Bh.: *Dungboo* 270.

S.T.: ? coll. 255, 338, s. n. in Herb. Calcutta.

Subsp. RHODOCEPHALUM.

Y.: *Forrest* 2665 (type of subsp.), 6418, 10846, 14694, 20199; *Kingdon Ward* 69, 1082; *Rock* 5424, 5706, 9880; *Schneider* 2145, 3132; *Handel-Mazzetti* 3634.

T.: *Forrest* 14657, 19046, 19885; *Kingdon Ward* 5981, 6201; *Handel-Mazzetti* 8150.

S.: *Kingdon Ward* 4210, 4643, 5380 (shade form).

B.: *Forrer* 1878.

I can find no distinction between the two subspecies except the degree of division of the leaf. This in itself would scarcely be sufficient to warrant subspecific rank, but the two groups are also completely segregated geographically. Certain specimens in the two groups tend to approach one another and make the relationship quite certain, *e.g.*, compare *Smith* & *Cave* 1771 and *Forrest* 19885. It is unfortunate that Diels's *C. rhodocephalum* has become a better-known plant than Bentham's *C. palmatum*, which, of course, has priority of name. The latter is very sparingly represented in collections, except in the Calcutta Herbarium.

4. C. BULBILLIFERUM W. W. Smith in Notes Roy. Bot. Gard. Edin. xii (1920), 200.

Stem glabrous below, minutely brown-woolly above, up to 25 cm. *Radical leaves* long petiolate, roundly reniform, glabrous, purplish below, dentition shallow crenate-mucronate. *Cauline leaves* reniform or reduced to vaginæ, the latter large and containing bulbils. *Capitula* usually solitary, large, hemispherical. *Phyllaries* linear oblong acute, about 12 mm. long, minutely brown-black hairy. *Disc-florets* deep orange, upper 2/3 subcylindric campanulate. *Ligulate florets* orange, ligule 2 to 2½ times the length of the tube, oblong lanceolate truncate dentate. *Pappus* white.

Habitat: Open alpine meadows; stony pastures and open screes; and on limestone cliffs, 13,000–15,000 ft.

Range: Extreme S.E. Tibet and N.W. Yunnan.

T.: *Forrest* 14635, 17229 (type), 20265.

Y.: *Handel-Mazzetti* 9718.

A little-known species. It is very closely related to the Chinese form of the next species, *C. Thomsoni,* and the presence of bulbils is the chief distinguishing feature.

5. C. THOMSONI C. B. Clarke in Comp. Indicæ (1876), p. 169.

Senecio nephelogetus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 285.

Stem minutely scattered black-hairy throughout its length or especially above, up to 25 cm. *Radical leaves* thin, long petiolate, roundly reniform, with few large triangular mucronate teeth (rarely small and more acute), glabrous on both surfaces. *Cauline leaves* (above the level of the radical leaves) either entirely absent or reduced to a single ligulate bract. *Capitula* large, medium-sized, hemispherical. *Phyllaries* about 12 mm. long, linear lanceolate acute, subglabrous or black-hairy at base. *Disc-florets* upper 3/4 or 4/5 subcylindric campanulate. *Ligulate florets* orange-yellow, ligule four times the length of the tube, obcuneate, deeply dentate, truncate. *Pappus* bronze to white.

Habitat : Open screes and rocky alpine pastures ; ledges of cliffs ; in peaty meadows ; turf on exposed hillsides ; among *Rhododendron* scrub. Sometimes on limestone, 12,000-16,000 ft.

Range : Southern and S.E Tibet, Sikkim, Bhutan, N.W. Yunnan, S.W. Szechuan, and Kansu.

T. : *Forrest* 14433, 14575, 16733, 16872, 19890, 19989.

S.T. : *Hobson* s. n. ; *Kingdon Ward* 5905, 6042.

Sk. : *Lepcha* 362, 883 ? ; *Ribu* & *Rohmoo* 6518 ; *Cooper* 309, 388 ; *Smith* & *Cave* 1616 ; *Hooker* 14 (type) : *Younghusband* s. n. ; *King's coll.* s. n.

Bh. : *Cooper* 1974.

S. : *Kingdon Ward* 4224, 4693.

Y. : *Forrest* 20175 ; *Kingdon Ward* 68, 961 ; *Rock*, 10318, 10324, 10340.

K. : *Farrer* 212.

Ribu & Rohmoo 882 is probably a hybrid of which *C. Thomsoni* is one parent ; it has slight differences in the florets and the very hairy phyllaries. Associated with Hooker's *Ligularia* 14 in Herb. Mus. Brit. are the leaves of *C. Decaisnei.* Clarke in his original description does not describe the flower. The Chinese specimens nearly all have a distinct facies. The Himalayan plants are all very slender and graceful ; those from China are robust and rather coarse, but I can find no structural difference between them. The Kansu specimens are slightly atypical in the increased hairiness of the phyllaries.

6. C. GRACILLIMUM W. W. Sm. in Notes Roy. Bot. Gard. Edin. x (1917), 27.

Stem glabrous below, sparingly araneose above, up to 25 cm. *Radical leaves* very long petiolate, petioles slender, roundly reniform, teeth close rather shallow mucronate, thinly araneose on both sides when young.

Cauline leaves generally few without vaginæ. *Capitula* of medium size solitary hemispherical. *Phyllaries* about 10 mm. long, lanceolate acute, araneose-pubescent. *Disc-florets* crimson, upper 3/4 cylindrical. *Ligulate florets* dull crimson, ligule trilobed at the apex. *Pappus* brownish-white.

Habitat: Moss-covered rocks on granite cliffs; granite rocks; among Rhododendrons; and in alpine grassland, 12,300–14,000 ft.

Range: Known from extreme N.E. Burma only.

B.: *Kingdon Ward* 1783 (type), 3361.

A very little-known species, of which I have seen only two specimens, both in the Edinburgh Herbarium. It appears to be closely related to *C. Thomsoni*.

7. C. PULCHRUM R. Good, sp. n.*

Stem glabrous below, brown pubescent above, up to 30 cm. *Radical leaves* long petiolate, thin, small, reniform, with relatively few acutely triangular teeth, glabrous. *Cauline leaves* few, nearly all much reduced. *Capitula* solitary in specimens seen, large, hemispherical. *Phyllaries* about 10 mm. long, elliptic lanceolate acute, purplish-black when dry, glabrous. *Disc-florets* small, upper 2/3 or 3/4 hypocrateriform campanulate. *Ligulate florets* white, tube very short, ligule large, oblong elliptic, rather deeply three-toothed. *Pappus* short, dirty white.

Habitat: Screes and ledges of cliffs and on open stony meadows on the margins of scrub, 12,000–14,000 ft.

Range: Extreme N.W. Yunnan and extreme N.E. Burma.

Y.: *Forrest* 25874.

B.: *Forrest* 26940, 27252 (type), 27293.

The delicate dark green leaves and the large but graceful heads with glabrous purple-black phyllaries and pure white ligules make this one of the most beautiful species of the genus. Its nearest affinity is with *C. Thomsoni*.

8. C. SMITHIANUM Hand.-Mazz. in Anz. Akad. Wiss. Wien. Math.-Nat. lxii (1925), no. 2, and Oest. Bot. Zeitschr. lxxii (1923), tab. iv, fig. 3.

Stem purplish, glabrous below, minutely brown-woolly above, up to 25 cm. *Radical leaves* long petiolate, roundly reniform, dentate, glabrous, coriaceous, green above with prominent white venation, usually purplish below with conspicuous veins ; teeth small, very numerous, mucronate. *Cauline leaves* reniform to linear, with small entire vaginæ. *Capitula* solitary, large, hemispherical. *Phyllaries* narrow lanceolate acute. minutely woolly pubescent or subglabrous. *Disc-florets* orange, upper 3/5 subcylindric. *Ligulate florets* yellow to orange, ligule four times the length of tube, elliptic truncate dentate. *Pappus* white.

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* *Herba* usque ad 40 cm.; *radicibus* crassis; *caulibus* gracilibus supra brunneo-pubescentibus; *foliis radicalibus* longepetiolatis, petiolis ad 15 cm. tenuibus glabris, laminis tenuibus late reniformibus ad 4 cm. in diam. grosse acuteque triangulato-dentatis, utrinque glabris, supra olivaceis, infra pallidioribus et venis brunneis; *foliis caulinis* paucis præcipue reductis lineari-lanceolatis; *capitulis* solitariis hemisphæricis ad 10 cm. in diam.; *phyllariis* ellipticis lanceolatis in sicco atropurpureis glabris; *floribus discoideis* parvis, parte 2/3–3/4 supero hypocrateriforme campanulato; *floribus ligulatis* albis, tubis brevissimis, ad apicem gradatim cuneatis profunde 3-dentatis c. 6-venis; *pappo* sordido albo.

Habitat: Open meadows and snowy hollows on limestone, crevices of cliffs and on drift, 11,000–14,000 ft.

Range : Extreme S.E. Tibet, N.W. Yunnan, and S.W. Szechuan.

Y : *Forrest* 2736, 6535, 6613, 22480 ; *Rock* 4811, 5294, 5420, 9883, 9892, 10383 ; *Delavay* 2474 ; *Handel-Mazzetti* 3635, 4729 (type), 8358 ; *Schneider* 1967, 3587.

T. : *Forrest* 15151.

S. : *Forrest* 16808, 17006.

A very beautiful species with peculiar foliage and venation. It appears to be confined to limestone districts.

9. C. Decaisnei C. B. Clarke in Comp. Indicæ (1876). 168.

Stem glabrous below, brown araneose above, up to 25 cm. *Radical leaves* rather stoutly long petioled, roundly reniform, shallow crenate mucronulate dentate, glabrous above, closely brownish-white tomentose below. *Cauline leaves* few and much reduced with small vaginæ. *Capitula* solitary, large, hemispherical. *Phyllaries* about 10–15 mm. long, linear lanceolate acute, closely brown lanate, especially towards the base. *Disc-florets* upper 2/3 to 3/4 subcylindric campanulate. *Ligulate florets* yellow to orange, ligule generally four times as long as the tube, which is rarely entirely absent, linear oblong subtruncate dentate. *Pappus* white.

Forma Clarkei R. Good, forma nov. Tuba corollæ ligulatæ adest.

Senecio venatus Franch. in Bull. Soc. Bot. Fr. xxix (1892), 286.

Forma sinense R. Good, forma nov. Tuba corollæ ligulatæ obsoleta.

Habitat : The Chinese form is found on limestone rocks. I have no notes on the habitat of the normal form. 12,000–18,300 ft.

Range : The species is found in the Western and Central Himalayas as far east as W. Bhutan and in S. Tibet. The form has been found only once in Yunnan.

Forma Clarkei.

W.H. : *Duthie* 177, 799, 799 *a*, 5697, 14161, 14162, 24527, s. n. ; *Lace* 1241 ; *Ellis* 225, 1626, 1697 ; *Madden* 487 ; *Stewart* 1801 ; *Jacquemont* 1122 ; *Falconer* 588 ; *Strachey & Winterbotham* 5 ; *Aitchison* 50 ; *Fuller* 149 ; *Benham* s. n. ; *Clarke* 29821.

Sk.: *Lepcha* 544; *Hooker* 7 (type).

Bh.: *Cooper* 1869.

S.T.: *Cooper* 1717, 1777; *Younghusband* 225; *Wollaston* 110; *Everest Exped.* 267.

Forma SINENSE.

Y.: *Handel-Mazzetti* 4728.

?: *Munro* 2692.

Many specimens bear the facies, when dried, of rather luxuriant *Ranunculus Ficaria.* Owing to the very inadequate original description of the species, there have been very many mis-identifications, and specially has there been confusion with *Cremanthodium Thomsoni*, which is at once distinguished by its entirely glabrous leaves.

Stewart 1801 is slightly abnormal in that the ligulate corollas are tubular for half their length and the styles are included.

10. C. FARRERI W. W. Sm. in Notes Roy. Bot. Gard. Edin. xxi (1920), 202.

Stem very loosely araneose throughout, up to 45 cm. *Radical leaves* long petiolate, roundly reniform, glabrous above, loosely araneose below, dentate; teeth large, shallow mucronate, reticulate venation prominent below. *Cauline leaves* reniform to linear or reduced to vaginæ. *Capitula* large, solitary, in specimens seen suburceolate. *Phyllaries* lanceolate, acute purplish-brown when dry, araneose in bud. *Disc-florets* greenish-yellow to orange, upper 2/3 to 3/4 of corolla subcylindric. *Ligulate florets* white becoming purple, tube usually obsolete, but the obcuneate ligules are usually themselves partly tubular. *Pappus* white.

Habitat: Dips and dells of the longer alpine grass; open stony alpine meadows, and sometimes on screes, 11,000–14,000 ft.

Range: N.E. Burma only.

B.: *Forrest* 22829, 24569, 24883, 24924, 26837, 26911, 26941, 26970, 27005, 27008, 27257, 27259, 27260, 27302; *Kingdon Ward* 3409; *Farrer* 1178 (type), 1875.

Forrest 22820, 22828, 20228 are possibly old specimens of this species, but cannot be determined accurately.

A very beautiful species with exceptionally strong fragrance which would prove of great garden value if it could be cultivated in this country. In one specimen, *Forrest* 26911, the flowers are described as yellow, but I think this must be an error, especially as a yellow-flowered species, *C. citriflorum*, grows in the same habitats. There is a photograph of the type-specimen of *C. Farreri in situ* in Gard. Chron. 1920, p. 204.

11. C. CITRIFLORUM R. Good, sp. nov.*

Stem slightly white araneose below, glabrous above, up to 25 cm. *Radical leaves* doubtful, since those associated with the flowers are not in organic connection with them. These leaves exactly match those of *C. Farreri*. *Cauline leaves* reniform, glabrous, dentate or reduced to vaginæ only. *Capitula* large, solitary in specimen seen, hemispherical. *Phyllaries* purple-black when dry, lanceolate, long acute, glabrous. *Disc-florets* upper 5/6 of corolla very narrow subcylindric campanulate. *Ligulate florets* citron-yellow; tube very short, ligule very long, linear cuneate lanceolate, tapering to the deeply 3-fid tip. *Pappus* bronze.

Habitat: Not general, but abundant in the slopes of alpine grass just below the pass along its western fall, 12,500 ft.

Range: Known only from the Chawchi Pass on the N.E. Burma frontier.

B.: *Farrer* 1179 (type).

I have not described the leaves associated with this specimen as belonging to the flowers for three reasons. First, they are not actually attached to the flowers; secondly, the photograph in Gard. Chron. 1920, p. 266, showing the plant *in situ* does not indicate any radical leaves; thirdly, the leaves are exactly those of *C. Farreri*, which grows in the same places. Under these circumstances it is a little difficult to make out the affinity of *C. citriflorum*. The flowers closely resemble those of *C. Delavayi*, but the leaves are as described above.

12. C. RENIFORME (Wall.) Benth. in Hook. Icon. Pl. xvii (1887), 1141.

Cineraria reniformis Spreng. in litt. ad Wall.
Senecio reniformis Wall. Cat. 3141.
Ligularia? reniformis DC. in Prod. vi (1837), 315.

Stem sparsely lanate above, quite glabrous and with the colour and texture of straw below, up to 90 cm. *Radical leaves* long petiolate, thin, reniform, glabrous, teeth few and shallow, petioles straw-like and persistent round stem. *Cauline leaves* reniform to linear, vaginæ large. *Capitula* large, solitary, hemispherical. *Phyllaries* oblanceolate with numerous black glandular hairs, especially numerous towards the base. *Disc-florets* upper 3/4 narrow, campanulate. *Ligulate florets* yellow, tube obsolete, ligule oblanceolate, subtruncate, dentate. *Pappus* white.

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* *Herba* ad 25 cm.; *caulibus* infra glabris striatis, supra leviter albo-araneosis; *foliis radicalibus*?; *foliis caulinis* petiolatis reniformibus vel vaginis reductis glabris; *capitulis* solitariis magnis hemisphæricis ad 12 cm. in diam.; *phyllariis* lanceolatisc. 15 mm. longis lanceolatis in sicco purpureo-nigris, longe acutis glabris basi ipso excepto; *floribus discoideis*, parte 5/6 supero angustissime cylindraceo-campanulato, c. 10 mm. longis; *floribus ligulatis*, c. 5 cm. longis pallide citrinis, tubo brevissimo, ligulis lineari-lanceolatis apice gradatim angustis profunde 3-dentatis, venis c. 15; *pappo* æneo, 6 mm. longo.

Habitat: In peat and along the sides of streams, 11,000–14,000 ft.

Range: Sikkim and extending for an unknown distance into Bhotan and Nipal.

Sk.: *Clarke* 13452, 12706, 12543, 12548, 25581, 25674, 25703, 26106; *Treuthe* 886; *Ribu & Rohmoo* 6629; *King's coll.* 4324; *Gamble* 8434; *Lepcha* 44; *Cooper* 570, 1011; *Hooker* s. n. (type); *Osmaston* s. n.; *Elwes* s. n.

Bh.: *Cooper* 776.

N.: *Wallich* 3141; *Manners-Smith* 18.

Some leaves show a tendency to be hastate acute, others to be very broadly and truncately reniform. The closeness and shallowness of the leaf-dentition also varies considerably. This species is the type-species of the genus *Cremanthodium*.

13. C. RETUSUM (Wall.) R. Good, comb. nov.

Senecio retusus Wall. Cat. 3142, et ex Hook. Flor. Brit. Ind. iii (1881), 350.
Ligularia retusa DC. Prod. vi (1837), 314.
Arnica? retusa Wall.
Cineraria? retusa Wall.

Stem slightly araneose above, glabrose below, up to 90 cm. *Radical leaves* long petiolate, roundly reniform, closely and acutely dentate, often very large, glabrous. *Cauline leaves* reniform to linear with large vaginæ. *Capitula* large, solitary, or in a very lax, few-headed raceme. *Phyllaries* narrow acute, green, glabrous except at the very base. *Disc-florets* with the upper 3/5 of corolla narrow subcylindric campanulate. *Ligulate florets* orange-yellow, ligule about three times the length of the tube, narrow elliptic, with about eight veins. *Pappus* white.

Habitat: Ledges of cliffs and stony pastures; by streams on alpine moorland, 12,000–15,000 ft.

Range: S. and S.E. Tibet, Sikkim, the Naga Hills in Assam, and extreme N.W. Yunnan.

S.T.: *Wallich* 3142 (type); *Scully* 279.

T.: *Forrest* 17232, 20405.

Sk.: *Cooper* 859, 933; *Clarke* 13452, 25575; *Lepcha* 430: *Smith & Cave* 2384; *Hooker* s. n.

Assam: *Clarke* 41314.

Y.: *Forrest* 6434, 6486, 14381 *pp.*, 14589; *Rock* 5417, 10011, 10415; *Kingdon Ward* 1005; *Handel-Mazzetti* 3631.

This and the next two species, *C. cremanthodioides* and *C. phœnicochætum*, are very closely related and connected by intermediate specimens, but they are maintained here because the type-specimens, at any rate, are quite distinct and the intermediates are considered as possible hybrids.

14. C. CREMANTHODIOIDES (Hand.-Mazz.) R. Good, comb. nov.

Ligularia cremanthodioides Hand.-Mazz. in Anz. Akad. Wiss. Wien. Math.-Nat. lxii (1925), no. 13.

Stem glabrous below, but above covered with short dark glandular hairs, up to 50 cm. *Radical leaves* long petiolate, roundly reniform, closely and acutely dentate, glabrous. *Cauline leaves* reniform to linear, vaginæ very large. *Capitula* of medium size, one to many, arranged in a corymb or umbel. *Phyllaries* narrow, acute, dark brown or black, more or less covered with short dark glandular hairs. *Disc-florets* upper 3/5 subcylindric. *Ligulate florets* less than twice as long as the phyllaries, yellow, ligule 2–3 times the tube in length, elliptic with about five nerves. *Pappus* white.

Habitat : Wet places and open stony pastures on alpine gravel, mica-schist, and limestone, 11,000–14,000 ft.

Range : Sikkim, extreme S.E. Tibet and extreme N.W. Yunnan.

Y.: *Forrest* 14496, 14565 ; *Handel-Mazzetti* 9622 (type), 9646, 9695.

T.: *Forrest* 19963.

Sk. : *Cooper* 602, 858.

Very close to *C. retusum* and possibly hybridises with it.

15. C. PHŒNICOCHÆTUM (Franch.) R. Good, comb. nov.

Senecio phœnicochætus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 295.

Stem glabrous below, minutely adpressed hairy above, up to 30 cm. *Radical leaves* long petioled, roundly reniform, firm, closely and acutely dentate with callose mucronate teeth, venation conspicuous below. *Cauline leaves* reniform to linear, with large vaginæ. *Capitula* solitary in all specimens seen, medium-sized, hemispherical. *Phyllaries* dark, narrow oblanceolate, subglabrous. *Disc-florets* yellow, upper 1/2 broadly campanulate. *Ligulate florets* yellow, ligule about twice the length of the tube, rather broad elliptic with about six veins, deeply toothed. *Pappus* very short, dingy purple.

Habitat: Open stony grassy slopes and pastures, 11,000–14,000 ft.

Range : Only known from extreme N.W. Yunnan.

Y.: *Forrest* 6598, 2927 *pp.*, 11129 ; *Rock* 5002, 5251, 9866 ; *Delavay* 2473 (type) ; *Schneider* 2003 ; *Handel-Mazzetti* 3630.

Very close to the two former species and possibly hybridises with them.

16. C. HOOKERI C. B. Clarke in Comp. Indicæ (1876), 169.

Stem glabrous below, white araneose above, up to 45 cm. *Radical leaves* long petiolate, hastate-cordate to roundly reniform, acutely dentate, glabrous, paler or purple below. *Cauline leaves* petiolate, reniform to linear, vaginate. *Capitula* solitary or racemose, medium-sized or small, usually campanulate. *Phyllaries* narrow acute, glabrous or slightly araneose towards the base. *Disc-florets* dull yellow, upper 1/2 subcylindric. *Ligulate florets* orange, ligule 2–3 times the tube, strap-shaped or narrow elliptic with about five veins, very rarely absent. *Pappus* usually yellow-brown.

Subspecies CLARKEI R. Good, subsp. nov. Capitulis solitariis vel 2–3 laxe aggregatis mediocribus.

Forma ANGUSTILIGULATUM R. Good, forma nov. Ligulis angustate ligulatis.

Senecio sikkimensis Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 285.
Senecio nimborum Franch. in Nouv. Arch. Mus. Par. ser. ii, x (1888), 39.
Senecio saccoso-flabellatus Lévl. in Fed. Rep. xii (1913), 283.
Senecio Feddei Lévl. in Fed. Rep. xiii (1914), 344.

Forma LATILIGULATUM R. Good, forma nov. Ligulis ovatis-oblongis truncatis, profunde dentatis.

Subspecies POLYCEPHALUM R. Good, subsp. nov. Capitulis 3 vel ultra, racemosis, parvis.

Forma REGULARE R. Good, forma nov. Capitulis parvis breviter pedunculatis, regulariter racemosis, ligulis rarissime obsoletis.

Senecio calthæfolius Hook. fil. in Flor. Brit. Ind. iii (1881), 351.
Senecio Atkinsoni C. B. Cl. in Comp. Ind. (1876), 207.
Senecio cacaliæfolius var. *Atkinsoni* Hk. fil. in Flor. Brit. Ind. *loc. cit.*
Senecio Léveilléi Vaniot in Bull. Geog. Bot. xi (1902), 346.
Senecio ficariæfolius Lévl. et Van. in Fed. Rep. viii (1910), 359.

Forma IRREGULARE R. Good, forma nov. Capitulatis longissime pedunculatis irregulariter racemosis, foliis cordatis hastatis acutis, venis reticulatis conspicuis.

Forma ANOMALUM R. Good, forma nov. Capitulis subcampanulatis, phyllariis latioribus, foliis crassis reniformibus, inconspicue reticulatis, vaginis caulinis magnis.

Habitat: Moist places in alpine meadows, open stony pastures, and sometimes on screes, 10,000–15,000 ft.

Range: Sikkim, S. and S.E. Tibet, and Western China as far north as Kansu and Shensi.

Subsp. CLARKEI f. ANGUSTILIGULATUM.

Shensi: *Giraldi* 3087 ; *Hugh* s. n. (locality, Miao-Wang-Shan Mts., not known).

K.: *Maire* 128, 248, s. n.; *Purdom* s. n. (ligules exceptionally long).

S.: *Handel-Mazzetti* 7245 ; *Wilson* 3804; *Kingdon Ward* 4426; *Soulié* 613.

Y.: *Forrest* 2927 *pp.*, 4055, 6250, 6492 *pp.*, 6991 *a*, 7012, 11702, 14564, 25704 ; *Handel-Mazzetti* 3633; *Delavay* 3800 ; *Rock* 4706, 6343.

S.T.: *Hobson* s. n.

T.: *Forrest* 17228, 14474.

Sk.: *Cooper* 410, 459, 574, 813; *Hooker* 16 (type of species); *Lepcha* 121 ; *Ribu & Rohmoo* 6583.

Subsp. CLARKEI f. LATILIGULATUM.

S.T.: *Cooper* 719.

Bh.: *Cooper* 3221.

Sk.: *Lepcha* 31, 34; *Hooker* 8, 15, 17; *Cooper* 603, 482, 576, 834, 756; *Elwes* s. n.; *W. W. Smith* 4253.

Subsp. POLYCEPHALUM f. REGULARE.

K.: *Maire* 129; *Cavalerie* 3366; *Bodinier & Martin* 1911.

S.: *Kingdon Ward* 4390, 4702; *Pratt* 654, 606.

Y.: *Forrest* 4054, 6377, 10781 (slightly atypical), 2907; *Delavay* 3693; *Rock* 6327, 9744.

Sk.: *Lepcha* 968, 1029.

Subsp. POLYCEPHALUM f. IRREGULARE.

S.: *Pratt* 465.

Subsp. POLYCEPHALUM f. ANOMALUM.

Y.: *Forrest* 6492 *pp.*

The most complex and difficult group in the whole genus. It doubtless represents a junction of *Ligularia* and *Cremanthodium*, a connection which has not yet become severed by any absolutely constant characters. The racemose part of the species is almost indistinguishable from the smaller forms of such species of *Ligularia* as *racemosa* and *sibirica*, but I believe that a character of distinction exists in the proportions of the capitula. In *Cremanthodium Hookeri* and, incidentally, all *Cremanthodia* the lower narrow part of the disc-floret is never as long as the pappus or phyllary, but in the few-headed Ligularias that I have seen the tube is as long, with the result that the expanded portion of the corolla is exserted from both pappus and phyllaries.

Although the species is here so much divided into subordinate groups, it must not be supposed that these are definitely segregated from one another. All pass into one another, but the extremes of the various tendencies are very unlike. For purely practical reasons I have given the two subspecies an entirely artificial diagnosis so that doubtful specimens may be as few as possible.

17. C. CALCICOLA W. W. Sm. in Notes Roy. Bot. Gard. Edin. xxi (1920), 201.

Stem glabrous below, yellow hairy above, up to 30 cm. *Radical leaves* long petioled, roundly reniform, shallowly apiculate crenate, glabrous, veins very inconspicuous. *Cauline leaves* reniform linear, vaginæ large. *Capitula* medium-sized, solitary in specimen seen. *Phyllaries* black-purple, glabrous subacute. *Disc-florets* orange. *Ligulate florets* none. *Pappus* yellowish.

Habitat: Limestone cliffs and screes, 14,000 ft.

Range: Known only from N.W. Yunnan.

Y.: ***Forrest*** **12711 (type).**

This species is of rather uncertain affinity, and it is difficult to say how far the absence of rays is a distinctive character. In many species of Composites both disc and radiate forms are known. *C. calcicola* is very closely approached by the small form of *C. retusum*, as seen in *Rock* 5002, and the presence of rays in this specimen is the most important difference between them.

18. C. ATROCAPITATUM R. Good, sp. nov.*

Stem shortly black-hairy, glabrous at the very base, up to 50 cm. *Radical leaves* long petiolate, roundly reniform, coarsely mucronate-dentate, glabrous on both surfaces. *Cauline leaves* few, petiolate, reniform to linear, dentate, vaginate. *Capitula* solitary in those seen, medium-sized, hemispherical. *Phyllaries* oblanceolate, subacute, irregularly fimbriate at the tip, black pubescent. *Disc-florets* upper 4/5 broadly cylindric campanulate. *Ligulate florets* none. *Pappus* bronze.

Habitat: "Abundant in the marshes of the high-alpine lawns. Flowers mere drooping lumps of black dinginess, never producing anything better in the way of florets," 12,800 ft.

Range : Known only from the Chawchi Pass in extreme N.E. Burma.

B.: *Farrer* 1877 (type).

Very close to *C. microcephalum*, but sufficiently distinct in the phyllaries, florets, and general habit.

The two *Forrest* numbers—25023 and 27272 from N.E. Upper Burma—seem to be atypical forms of this species. They have, perhaps, a hybrid origin.

19. C. MICROCEPHALUM Hand.-Mazz. in Anz. Akad. Wiss. Wien. Math.-Nat. lvii (1920), 174.

Stem glabrous below, thinly white araneose above, up to 30 cm. *Radical leaves* long petiolate, roundly and sometimes emarginately reniform, closely and acutely dentate, venation conspicuous below, glabrous above, minutely harsh pubescent below. *Cauline leaves* very few or none, vaginæ large. *Capitula* small, hemispherical, in few-headed cymes. *Phyllaries* broad acute, dark, sparsely araneose near the base. *Disc-florets* dull orange, upper 2/3 to 3/4 subcylindric. *Ligulate florets* none. *Pappus* white to reddish.

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* *Herba* usque ad 50 cm.; *caulibus* striatis, nigro-pilosis; *foliis* radicalibus longe petiolatis, petiolis ad 15 cm. glabris basi ipso vaginatis, rotundato-reniformibus ad 6 cm. in diam., mucronato-dentatis, utrinque glabris, infra pallidioribus venis reticulatis brunneis conspicuis; *capitulis* subsolitariis 2–2·5 cm. in diam., hemisphericis; *phyllariis* obcuneatis acutis apice irregulariter fimbriatis nigro-pubescentibus; *floribus discoideis* parte 4/5 supero late cylindraceo-campanulato; *floribus ligulatis* nullis; *pappo* æneo; *achænio* submaturo, angustate oblongo glabro striato.

Habitat : Mountain ditches and open rocky slopes, 13,000–14,500 ft.

Range : Known only from extreme N.W. Yunnan.

Y. : *Forrest* 14381 *pp* ; *Rock* 10031 ; *Handel-Mazzetti* 4735 (type).

The following specimens do not fall readily under any species of the genus, but most closely resemble *C. microcephalum*, and are possible hybrids in which this species is a parent ; they are all from Yunnan :—*Forrest* 20164 ; *Rock* 9428, 9660.

A very difficult and confused species, very little known in the typical condition.

20. C. PRINCIPIS (Franch.) R. Good, comb. nov.

Senecio Principis Franch. in Journ. de Bot. x (1896), 413.

Stems glabrous below, puberulous lanuginous above, up to 30 cm. *Radical leaves* long petiolate, ovate suborbicular to subquadrate, venation subpinnate, widely sinuate dentate, rufescent woolly below, without vaginæ. *Cauline leaves* linear lanceolate bracteiform without vaginæ, several. *Capitula* large, solitary, hemispherical. *Phyllaries* lanceolate acute, dorsally papillose hairy, upper edges minutely white-hairy. *Disc-florets* not seen. *Ligulate florets* yellow, ligules oblong lanceolate truncate, rather markedly 3-dentate. *Pappus* dirty white.

Habitat : No information.

Range : Extreme N.W. Yunnan only.

Y. : *Prince Henri d'Orleans* s. n. (type).

A handsome species, known only from the single collecting in the Paris Herbarium. M. Lecomte very kindly provided me with accurate drawings of the plants, and the above is compiled from them with the help of the original description. The venation and shape of the leaves place this species very close to *C. gypsophilum*, but it is easily distinguished by the pilose phyllaries and the tomentum on the underside of the leaves. In this latter character it shows relationship with *C. Decaisnei*.

21. C. GYPSOPHILUM R. Good, sp. nov.*

Stem glabrous below, woolly pubescent above, up to 15 cm. *Radical leaves* petiolate, oblong reniform cordate, closely and regularly shallowly mucronate dentate, venation semi-pinnate, median vein stronger. *Cauline leaves* bracteiform and usually single. *Capitula* medium, solitary, campanulate. *Phyllaries* about 19 mm. long, narrow lanceolate, acute, glabrous. *Disc-florets* deep olive-yellow, upper 2/3 subcylindric campanulate. *Ligulate florets* bright brassy yellow, ligule three times as long as the tube, oblong lanceolate, truncate, dentate. *Pappus* bronze.

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* *Herba* nana usque ad 15 cm., radicibus crasso-fibrosis; *caulibus* infra glabris supra lanato-pubescentibus, basi reliquiis fibrosis petiolorum cinctis; *foliis radicalibus* petiolatis, petiolis crassis ad 3–4 cm., oblongo-reniformibus cordato-rotundatis ad 2·5 × 2 cm., minute et regulariter mucronato dentatis, venis secondariis subpinnatis, utrinque glabris; *foliis caulinis* uno bracteiformo reductis; *capitulis* solitariis mediocribus campanulatis ad 5 cm. in diam.; *phyllariis* c. 11 ad 10 mm. longis anguste lanceolatis acutis glabris; *floribus discoideis* olivaceis luteis parte 2/3 supero anguste campanulato; *floribus ligulatis* luteis ligulis quam tubis 3-plo longioribus oblongo-lanceolatis truncatis 3-dentatis; *pappo* æneo 7 mm. longo.

Habitat: On limestone drift, 13,000 ft.

Range: N.E. of Yangtse bend in N.W. Yunnan.

Y.: *Forrest* 10933 (type).

Distinguished by the small habit, campanulate heads, and the leaf-shape from both *C. cyclaminanthum* and *C. pseudo-oblongatum*. The cordate leaf-bases, the small regular dentition, and the nearly pinnate venation are the most important leaf-features. It has been collected once only and may be a hybrid between two better-known species. It bears an extraordinarily close superficial resemblance to a much reduced single-headed form of *Ligularia robusta* DC. from the Russian province Semipalatinsk, in Herb. Leningrad. This latter is, however, loosely white-lanate and has erect heads.

22. C. CYCLAMINANTHUM Hand.-Mazz. in Anz. Akad. Wiss. Wien. Math.-Nat. lxii (1925), no. 2.

Stem glabrous below, brown velvety pilose above, up to 25 cm. *Radical leaves* long petiolate, broadly ovate, or suborbicular cordate acute, with very few crenate teeth, glaucescent below. *Cauline leaves* none. *Capitula* of medium size, solitary, hemispherical. *Phyllaries* about 12 mm. long, lanceolate, acute, brown-pilose. *Disc-florets* yellow, upper 4/5 or 5/6 campanulate. *Ligulate florets* yellow, ligule oblong, obsoletely toothed. *Pappus* reddish.

Habitat: Alpine meadows, on limestone, 14,000 ft.

S.: *Handel-Mazzetti* 7450 (type).

A very ill-defined and little-known species based on rather unsatisfactory material. The author says that the florets of the disc are male, a feature unparalleled in the genus.

23. C. ACERNUUM R. Good, sp. nov.*

Stem slender, glabrous below, puberulous above, up to 30 cm. *Radical*

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* *Herba* usque ad 30 cm.; *caulibus* gracilibus supra puberulis; *foliis radicalibus* longe petiolatis, petiolis glabris ad 10 cm., parvis ad 4 cm. in diam. late reniformibus variatim incisis et dentatis, dentibus magnis paucis acutis, supra pallidioribus venis reticulatis inconspicuis; *foliis caulinis* uno bracteiforme reductis prope capitulum; *capitulis* erectis mediocribus hemisphærico-campanulatis ad 5 cm. in diam.; *floribus discoideis* 6 mm. longis, parte 1/2 vel 2/3 corollæ supero late campanulato; *floribus ligulatis* albis, ligulis quam tubis 4-plo longioribus c. 15 mm. longis, oblongis ellipticis; *pappo* albo brevo 3-4 mm. longo; *achæniis* immaturis elongatis 5 mm. longis.

leaves on long and slender petioles, small and very variable, broadly and shallowly reniform, but variously incised by a few large acute teeth, pale below and venation inconspicuous, glabrous. *Cauline leaves* absent or reduced to a single bract. *Capitula* of moderate size, solitary, erect, subcampanulate. *Phyllaries* about 12 mm. long, linear oblanceolate acute, dark and glabrous. *Disc-florets* with the upper half broadly campanulate. *Ligulate florets* white, ligule three to four times as long as the tube, elliptic oblong, truncate, dentate. *Pappus* white.

Habitat: In finer grassy intervals along the *arêtes*, 12,800 ft.

Range: Only from the Burmese–Chinese frontier.

B.: *Farrer* 1876 (type).

Very near to *C. Limprichtii*, but the leaves are essentially reniform although much modified, and the heads are quite erect.

24. C. POTANINI C. Winkl. in Act. Hort. Petrop. xiv (1895), 150.

Senecio kialensis Franch. in Journ. de Bot. x (1896), 413.

Cremanthodium Limprichtii Diels in Beih. Fed. Rep. xii (1922), 510.

Stem glabrous below, white araneose above, up to 25 cm. *Radical leaves* long and finely petiolate, cordate hastate, regularly triangularly dentate except at the tip, glabrous except for the araneose tip of the petiole. *Cauline leaves*: lower cordate hastate, upper linear bracteiform. *Capitula* solitary, campanulate, semi-erect. *Phyllaries* about 10 mm. long, linear lanceolate acute, araneose on the margin. *Disc-florets* yellow, upper 3/4 to 4/5 cylindric campanulate. *Ligulate florets* orange-yellow, tube short, ligule very narrow linear with about six veins. *Pappus* brownish.

Habitat: No information, no altitude given.

Range: S.W. Szechuan and extreme S. Kansu.

S.: *Soulié* 704; *Limpricht* 1873; *Weigold* s. n.; *Potanin* s. n.

K.: *Potanin* s. n. (type).

The most important feature of this species are the semi-erect heads. This species connects *C. acernuum*, in which the heads are definitely erect, with the rest of the genus.

25. C. PRATTII (Hemsl.) R. Good, comb. nov.

Senecio Prattii Hemsl. in Hook. Icones Pl. xxv (1896), 2491.

Stem glabrous below, araneose above, up to 30 cm. *Radical leaves* long petiolate, truncate or subcordate at the base, ovate acute, glabrous, subentire. *Cauline leaves* lanceolate, blunt, scarcely sheathing, usually single. *Capitula* large, solitary, hemispherical. *Phyllaries* lanceolate, acute, white araneose, about 10 mm. long. *Disc-florets* yellow, upper 2/3 cylindric campanulate. *Ligulate florets* yellow, ligule about eight times as long as the tube, tapering linear lanceolate, rather deeply toothed. *Pappus* white.

Habitat: No information, somewhere between 9000–13,5000 ft.

Range: Known from S.W. Szechuan only.

S.: *Pratt* 492 (type), 548, 593.

Rather close to *C. stenactium*, especially in the shape and size of the capitula. There is also a general resemblance to *C. Potanini*, especially about the leaves.

26. C. FORRESTII J. F. Jeff. in Notes Roy. Bot. Gard. Edin. v (1912), 191.

Stem glabrous, up to 25 cm. *Radical leaves* long and finely petiolate, deltoid hastate or sagittate, entire or irregularly toothed, glabrous on both sides. *Cauline leaves* absent or reduced to a single bract. *Capitula* solitary, large, suburceolate. *Phyllaries* about 12 mm. long, ovate lanceolate, long acute, glabrous, often darker on the margins when dry. *Disc-florets* greenish yellow, upper 3/4 to 4/5 cylindric campanulate. *Ligulate florets* orange-yellow or crimson, ligule about five times as long as the tube, obcuneate truncate 3-lobate. *Pappus* bronze.

Habitat: Humid meadows; open alpine pastures, and stony pastures on mica-schist, 11,000–14,000 ft.

Range: Extreme S.E. Tibet and extreme N.W. Yunnan.

T.: *Forrest* 14649, 16875, 20011.

Y.: *Forrest* 638 (type), 660, 14307, 19487, 13290; *Rock* 10076: *Monbeig* s. n.; *Handel-Mazzetti* 8421, 9981, 9487, 9538.

Distinguished from *C. Potanini* by the more strictly deltoid leaves with very few or no teeth and by the broader and shorter ligules.

27. C. ATROVIOLACEUM (Franch.) R. Good, comb. nov.

Senecio atroviolaceus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 303.
Senecio oreotrephes W. W. Sm. in Notes Roy. Bot. Gard. Edin. viii (1913), 116.

Stem clothed throughout with spreading multicellular hairs finer and softer above, up to 40 cm. *Radical leaves* long-petioled, cordate hastate, subacute, minutely shallow dentate, glabrous above, veins below and petioles black-hairy. *Cauline leaves* cordate hastate to linear, vaginæ large black-hairy. *Capitula* small, in few-headed corymbs. *Phyllaries* rather few, linear lanceolate acute, dark crimson and more or less black-hairy all over. *Disc-florets* dull orange, upper 3/4 narrow subcylindric campanulate. *Ligulate florets* none. *Pappus* yellowish

Habitat: Stony pastures and meadows, 11,000–12,000 ft.

Range: Known only from extreme N.W. Yunnan.

Y. *Forrest* 6548, 10946, 22487; *Rock* 5979; 5979 *a*, 10840; *Delavay* 3897 (type).

A very distinct species, especially characterized by its black hairiness, a feature which is found also in *C. nobile*, a species which is otherwise very different.

28. C. Delavayi (Franch.) Diels ex Lévl. Cat. Pl. Yunnan (1915), 43.

Senecio Delavayi Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 286.

Stem glabrous below, woolly pubescent above, up to 90 cm. *Radical leaves* long and stoutly petiolate, hastate, truncate at base, glabrous above, pubescent on the veins beneath when young, very shallow dentate, coriaceous, and with prominent venation when old. *Cauline leaves* ovate, vaginate, or reduced to vaginæ only. *Capitula* large, solitary, hemispherical. *Phyllaries* purplish, elliptic acute, glabrous, about 16 mm. long. *Disc-florets* dull orange, upper 4/5 broadly cylindric campanulate. *Ligulate florets* golden yellow, tube almost obsolete, ligule very long, very narrow elliptic or often linear elliptic, tapering towards the deeply dentate tip. *Pappus* bronze.

Habitat : Lush, stony, and alpine pastures, 11,000–13,000 ft.

Range : Extreme N.E. Burma and N.W. Yunnan.

B. : *Forrest* 24884, 26983, 27309.

Y. : *Forrest* 4049 ; *Delavay* 52 (type).

A very beautiful species with a very strong fragrance. One of the few amenable to English climates, but rather too large a plant for the small rockery.

29. C. oblongatum C. B. Clarke in Comp. Indicæ (1876), 168.

Senecio oblongatus (C. B. Clarke) Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 286 (as to var. *α* only).

Ligularia arnicoides DC. Prod. vi (1837) 314, in part

Senecio trichopoda Lévl. in Bull. Geog. Bot. xxv (1915), 17.

Stem glabrous below, lightly araneose above, up to 30 cm. *Radical leaves* long petiolate, petiole very gradually widened above, broadly ovate oblong, rarely broad elliptic, truncate, cuneate at the base, subacute, irregularly coarsely dentate, glabrous or araneose when young. *Cauline leaves* covering most of the flowering stems and with large vaginæ. *Capitula* large and solitary or smaller and in a few-headed raceme. *Phyllaries* linear lanceolate acute, araneose below, about 10 mm. long. *Disc-florets* upper 2/3 or 3/4 subcylindric campanulate. *Ligulate florets* yellow, ligule three times as long as the tube, linear or linear oblong or rarely broader with about three veins. *Pappus* bronze.

Habitat : No information, 10,700–15,000 ft.

Range : Western Himalayas (Garwhal), Nipal, Tibet, and Sikkim, and reappearing in Kansu.

W.H. : *Drummond* 22171 *pp.*

S.T. : *Hingston* 399.

N. : *Manners-Smith* 57.

Sk. : *Ribu & Rohmoo* 6670, 6671 ; *Hooker* s. n. (type) ; *Dungboo* s. n. ; *Lepcha* 218 ; *Cooper* 3295.

K. : *Maire* s. n., s. n. (both racemose).

A most unsatisfactory species, in which the type does not seem to be the most usual form. In its typical condition it is distinct enough, but there are a number of specimens varying slightly from the type but which cannot be included under any other species. For example, the two Kansu specimens have exactly the typical facies, foliage, and habit, but have rather numerous smaller heads arranged racemosely. Small forms of *C. arnicoides* also tend to approach this species. The status of *oblongatum* is also very uncertain, and additional knowledge may show it to be of hybrid origin. In the Kew library is a copy of Comp. Indicæ annotated and interleaved by the author, presumably in preparation for a second edition. Here the author's species, *C. oblongatum*, is definitely restricted to var. *α* of the printed edition. According to the arrangement of this revision var. *β* is now placed under *C. plantagineum* Max.

30. C. SINO-OBLONGATUM R. Good, sp. nov.*

Stem loosely white araneose, up to 20 cm. *Radical leaves* long petiolate, thick, spade-shaped, truncate at base, coarsely and irregularly dentate, glabrous, reticulate venation conspicuous below. *Cauline leaves* numerous, oblong to linear, dentate, cuneate below without vaginæ. *Capitula* large, solitary, hemispherical. *Phyllaries* lanceolate long acute, greenish pubescent, about 18 mm. long. *Disc-florets* upper 3/4 or 4/5 subcylindric campanulate. *Ligulate florets* yellow, ligules about five times as long as the tube, obcuneate elliptic, truncate, rather deeply four-toothed. *Pappus* white.

Habitat: No information, no altitude given.

Range: Known only from extreme N.W. Yunnan.

Y.: *Rock* 10443 (type), 10414.

Resembles the true *C. oblongatum* in the foliage, but the leaves are thicker and neater in appearance and the dentition is more marked. The cauline leaves almost overlap and are without vaginæ. The ligules also are quite distinct.

31. C. ARNICOIDES (Wall.) R. Good, comb. nov.

Senecio arnicoides Wall. Cat. et Herb. 3138.
Ligularia arnicoides DC. var. *glabrata* DC. in Prod. vi (1837), 314.
Senecio scytophyllus Diels in Notes Roy. Bot. Gard. Edin. v (1912), 193.

Stem glabrous below, loosely white araneoso above, up to 90 cm. *Radical*

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* *Herba* parva usque ad 20 cm.; *radicibus* crassis; *caulibus* laxe albo-araneosis, basi reliquiis fibrosis petiolorum cinctis; *foliis* radicalibus longe petiolatis, petiolis crassis ad 6 cm., coriaceis paleæformibus subacutis basi truncatis grosse acuteque dentatis ad 4·5 cm. in diam., utrinque glabris, infra atropurpureis venis reticulatis prominentibus; *foliis caulinis* numerosis, plerumque caulem totam obtegentibus, ovatis vel linearibus dentatis basi cuneatis; *capitulis* solitariis hemisphericis; *phyllariis* c. 18 cm. longis lanceolatis longe acutis subviridibus pubescentibus; *floribus discoideis* 6 mm. parte 4/5 supero subcylindraceo-campanulato; *floribus ligulatis*, tubo c. 2 mm., ligulis c. 18 mm. luteis ellipticis vel obcuneatis profunde 4-dentatis c. 10–12 venis; *pappo* albo 5–6 mm. longo; *achæniis* immaturis oblongatis.

leaves very large and stout-petioled, thin, oblong ovate acute, truncate at the base, acutely dentate, glabrous or thinly araneose below. *Cauline leaves* sessile, clasping, triangular cordate acute, dentate, without vaginæ, loosely araneose below or glabrous. *Capitula* large, in a very loose few-headed raceme or solitary, hemispherical. *Phyllaries* lanceolate acute, loosely araneose below, about 12 mm. long. *Disc-florets* upper 2/3 or 3/4 cylindric campanulate, often with white ciliate margins. *Ligulate florets* yellow, ligule about six times the length of the tube, elliptic or broad elliptic, rather deeply toothed. *Pappus* white.

Habitat: Grassy openings in pine forests and stony alpine pastures below limestone cliffs, 8000–14,000 ft.

Range: Western Himalayas and neighbouring and southern Tibet, Sikkim, and Yunnan.

W.H.: *Jacquemont* 1123, 1413, 1878 (atypical); *Edgeworth* 5047; *Thomson* s. n.; *Drummond* 22168, 22169, 22170, 22303, 22305; *Strachey* & *Winterbotham* 6; *Benham* s. n.; *Duthie* 833 *a*, 833 *b*, 834, 24544, 24550; *Lace* 1003; *Madden* 486; *Falconer* 99; *Schlagintweit* 10030; *Mackinnon* s. n.

S.T.: *Wallich* 3138 (type); *Walton* s. n.; *Wollaston* 144.

S.: *Ribu* 3018.

Y.: *Forrest* 2964, 7016, 10884; *Schneider* 2370.

One of the largest species in the genus. The most distinctive feature is the very large thin radical leaves, but as the plant is rarely collected whole, the best diagnostic character is in the cauline leaves.

The Chinese specimens have been described as *S. scytophyllus* Diels. I have compared them most carefully with the Indian and Tibetan ones, and I am unable to see any significant differences. They are, it is true, more glabrous, but they come from a drier region. Diels mentioned, as points of distinction, the less numerous bracts and ligules and differences in the flowers. When a range of specimens is examined these apparent distinctions entirely disappear.

32. C. RUMICIFOLIUM (J. R. Drumm.) R. Good, comb. nov.

Senecio rumicifolium J. R. Drumm. in Kew Bull. (1911), 371.

Stem glabrose, white araneose above, up 50 cm. *Radical leaves* large and thin, oblong ovate, blunt, truncate below, mucronate dentate, loosely araneose when young. *Cauline leaves* sessile, ovate oblong, clasping below. *Capitula* medium, in a dense apical raceme, peduncles shorter than the capitula. *Phyllaries* lanceolate acute, densely araneose towards the base, about 14 mm. long. *Disc-florets* yellow, upper 2/3 to 3/4 subcylindric campanulate. *Ligulate florets* yellow, 2 or 3 times as long as the tube, elliptic truncate, dentate. *Pappus* white.

Habitat: No information, 15,000 ft.

Range : Known from S. Tibet only.

S.T. : *Walton* s. n. (type).

Apparently related to *C. arnicoides*, but with a close raceme. A very little-known species.

33. C. PLEUROCAULE (Franch.) R. Good, comb. nov.

Senecio pleurocaulis Franch. in Journ. de Bot. viii (1894), 365.

Senecio tatsienensis Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 293.

Ligularia pleurocaulis Hand.-Mazz. in Anz. Akad. Wiss. Wein. Math.-Nat. (1925), no. 13.

Stem either entirely glabrose or very scanty araneose above, up to 90 cm. *Radical leaves* subsessile, rather fleshy, linear elliptic oblanceolate to broad lanceolate, glabrous, venation parallel. *Cauline leaves* linear, subulate, acute, scarcely clasping. *Capitula* small hemispherical, often long pedunculate, in a few- or many-headed raceme. *Phyllaries* few, ovate lanceolate, acute, glabrous, with hairy tips. *Disc-florets* yellow, upper 3/4 to 4/5 rather broad cylindric campanulate. *Ligulate florets* yellow, ligule four times as long as the tube rotund-spathulate rounded at the tip. *Pappus* white.

Forma FRANCHETII R. Good, forma nov. Habitu gracile, foliis angustis, racemis paucicapitatis.

Forma UBERRIMA (Hand.-Mazz.) R. Good, comb. nov. Plantæ majores, foliis latioribus, racemis multicapitulatis.

Ligularia pleurocaulis f. *uberrima* Hand.-Mazz. *loc. cit.*

Habitat : Bogs and marshes ; by streams ; moist pastures ; marshy ground near ponds; open alpine pastures ; the form also on limestone and sandy schist.

Range : The species as a whole is found in extreme N.W. Yunnan and S.W. Szechuan ; the form only from the former ; 10,000–14,000 ft.

Forma FRANCHETII.

Y. : *Forrest* 105, 11211, 13205, 16900 ; *Handel-Mazzetti* 4621 ; *Rock* 10549, 10867 ; *Schneider* 2370 (very tiny heads), 2180.

S. : *Wilson* 2491, 3784, 4682 ; *Kingdon Ward* 4481 ; *Pratt* 441 (type of species) ; *Soulié* 73, 232, 558.

Forma UBERRIMA.

Y. : *Forrest* 2918, 6625, 11165, 15236, 22226 ; *Handel-Mazzetti* 4774, 7422 ; *Schneider* 2368.

Although, as far as is known, the heads are always in a raceme and often very numerous, they are typically those of *Cremanthodium*, and, if solitary, there would be no question of the genus. It has already been seen that the number of heads cannot be used as a generic character, and I have therefore transferred this species and *C. plantaginifolium* to this genus. *C. pleurocaule* is closely related to certain racemose Ligularias, and forms the rather arbitrary limit of *Cremanthodium* in their direction.

34. C. LINEARE Max. in Bull. Acad. Peters. xxvii (1881), 483.

Senecio armerifolius Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 287.

Stem almost glabrous, minutely pubescent above, up to 25 cm. *Radical leaves* subsessile, very narrow linear, acute, rather broader towards the tip, glabrous, entire. *Cauline leaves* linear subulate, slightly clasping at the base, numerous and overlapping. *Capitula* of medium size, solitary, hemispherical. *Phyllaries* greenish, lanceolate acute, glabrous or minutely pubescent, about 10 mm. long. *Disc-florets* brownish yellow, upper 2/3 to 3/4 subcylindric campanulate. *Ligulate florets* yellow, ligule about six times as long as the tube, narrow lanceolate, long acute. *Pappus* white.

Habitat: Alpine meadows, steppes, and bogs, 10,000–13,000 ft.

Range: Kansu and W. Szechuan.

K.: *Ridley* 16; *Purdom* s. n.; *Mesny* ex herb. Hance 22014; *Prjewalski* s. n. (type); *Ching* 819.

S.: *Wilson* 3808.

The linear subulate leaves distinguish this species at sight from all others.

35. C. PLANTAGINIFOLIUM (Franch.) R. Good, comb. nov.

Stem glabrous or very sparingly araneose above, up to 60 cm. *Radical leaves* oblanceolate acute or ovate elliptic, sessile, gradually narrowed below, glabrous, entire or repand dentate, pinnately veined. *Cauline leaves* lanceolate ovate, acute, scarcely touching. *Capitula* small or medium, campanulate to hemispherical, solitary or in a raceme, which may be lax or dense and regular. *Phyllaries* lanceolate or linear lanceolate, acute glabrous. *Disc-florets* yellow, upper 3/4 to 4/5 subcylindric campanulate. *Ligulate florets* yellow, ligule three to five times as long as the tube, very variable in shape, linear lanceolate to elliptic. *Pappus* white.

Subspecies FRANCHETII R. Good, subsp. nov. Capitulis paucis vel numerosis, foliis radicalibus longis angustisque.

Forma ANGUSTILIGULATUM R. Good, forma nov. Ligulis lineari-lanceolatis, capitulis majoribus paucis in racemo laxo.

Senecio plantaginifolius Franch. in Bull. Soc. Philom. de Paris, ser. 8 (1891), 145.

Forma LAGOTIS (W. W. Sm.) R. Good, comb. nov. Ligulis ellipticis brevibus, capitulis majoribus paucis in racemo laxo.

Senecio Lagotis W. W. Sm. in Journ. et Proc. R. As. Soc. Bengal, vii (1911), 70.

Forma WINKLERI R. Good, forma nov. Capitulis parvis numerosis, in racemo denso regulare.

Senecio liatroides C. Winkl. in Act. Hort. Petrop. xiii (1893), 8.

Subspecies OLIGOCEPHALUM R. Good, subsp. nov. Capitulis solitariis vel subsolitariis, ligulis longis, foliis radicalibus late ovalibus spathulatis.

? *Senecio Virgaurea* Max. in Bull. Acad. Peters. xxvii (1881), 484, in part.

Habitat: Rain mountains and open stony pastures and alpine grass, 10,000–14,000 ft.

Range: Species from Sikkim and S. Tibet to Yunnan, Szechuan, and Kansu; subspecies *oligocephalum* known only from Kansu.

Subspecies FRANCHETII forma ANGUSTILIGULATUM.

S.: *Wilson* 3785; *Handel-Mazzetti* 7413.
Y.: *Forrest* 11062, 11217, 11286; *Rock* 5971; *Handel-Mazzetti* 7666.
K.: *Farrer* 207, 244, 744; *Licent* 4579, 4731.

Forma LAGOTIS.

Sk.: *Lepcha* 30, 572; *Cooper* 1587, 1879; *King's coll.* 4324, s. n.
S.T.: *Cooper* 261; *Hobson* s. n.
K.: *Ching* 512.

Forma WINKLERI.

S.: *Wilson* 3792; *Pratt* 654 (type of species); *Soulié* 850; *Potanin* s. n.

Subspecies OLIGOCEPHALUM.

K.: *Farrer* 206; *Ching* 698; *Przewalski* s. n.

A very difficult and polymorphic species. The various forms are connected by intermediates and are not markedly segregated geographically. The species compares in constitution very closely with *C. Hookeri*.

36. C. NOBILE (Franch.) Diels in Lévl. Cat. Pl. Yunnan, (1915), 43.

Senecio nobilis Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 287.

Stem covered rather thickly with black multicellular hairs, up to 45 cm. *Radical leaves* subsessile or shortly petiolate, obovate or broad elliptic, subacute glabrous, dentition very shallow and distant, mucronate, venation pinnate. *Cauline leaves* elliptic linear. *Capitula* large, solitary, hemispherical. *Phyllaries* lanceolate acute, black-hairy along the centre, about 18 mm. long. *Disc-florets* dull orange, upper 3/4 cylindric campanulate. *Ligulate florets* golden yellow, tube very short, ligule very long, narrow elliptic to tapering linear, among the longest of the genus. *Pappus* white.

Habitat: Grassy slopes below limestone cliffs; open pastures, and shrub-clad slopes on limestone, 11,000–14,500 ft.

Range: Extreme N.W. Yunnan, S.E. Tibet, and S.W. Szechuan.

Y.: *Forrest* 2724, 6252, 15364, 20806, 21504, 21566; *Rock* 4832, 4978, 5208, 9048, 9882, 10548, 11449, 11456; *Delavay* 53 (type); *Handel-Mazzetti* 3527; *Schneider* 1811, 3449.

T.: *Forrest* 15228.

S.: *Forrest* 16801, 17005; *Kingdon Ward* 4013, 4623, 5232; *Rock* 5575; *Handel-Mazzetti* 7269.

A very beautiful species with strong fragrance and very large heads. It is rather variable in leaf-shape, but is always recognizable by its black multicellular hairs.

37. C. PLANTAGINEUM Max. in Bull. Acad. Peters. xxvii (1881), 482.

Stem glabrous below, steel-grey lanate-hairy above, rarely white lanate, up to 90 cm. (f. *Ellisii*), usually up to 30 cm. *Radical leaves* spathulate to elliptic, long cuneate below, acute, repand dentate, glabrous, very variable in size, cuneate base sometimes very long. *Cauline leaves* smaller, sessile. *Capitula* large or medium, solitary, or few in a very lax raceme or cyme. *Phyllaries* lanceolate acute, densely steel-grey woolly, rarely white, to 14 mm. long. *Disc-florets* dull yellow, upper 2/3 narrow campanulate. *Ligulate florets* yellow, tube almost obsolete, ligule elliptic, rounded at the tip, teeth small. *Pappus* white.

Forma MAXIMOWICZII R. Good, forma nov. Plantæ parvæ, capitulis solitariis mediocribus griseo-lanatis.

Cremanthodium Fletcheri Hemsl. in Journ. Linn. Soc. xxxv (1902), 185.
Cremanthodium oblongatum C. B. Clarke var. β. Comp. Indicæ (1876), 169.
Senecio arnicoides var. *frigida* Hook. fil. in Flor. Brit. Ind. iii (1881), 351.
Senecio paberensis Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 288.
Senecio Maximowiczii Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 287.
Senecio Fletcheri Hemsl. in Kew Bull. (1896), 212.

Forma ELLISII (Hook. fil.) R. Good, comb. nov. Habitu altissima et capitulis grandis in racemo laxissimo confertis.

Werneria Ellisii Hook. fil. in Flor. Brit. Ind. iii (1881), 351.

Forma GORINGENSE (Hems.) R. Good, comb. nov., capitulis mediocribus in cymis confertis.

Senecio goringensis Hemsl. in Kew Bull. (1896), 212.
Cremanthodium goringense Hemsl. in Journ. Linn. Soc. xxxv (1902), 185.

Forma ALBIDUM R. Good, forma nov. Plantæ parvæ albo-araneosæ vel lanatæ vice griseo-lanatæ.

Habitat: On rocks and screes in moist meadows and in alpine grasslands. The f. *Ellisii* occurs in the damper places. Forma *Maximowiczii*, 9000–18,000 ft.; f. *Ellisii*, 12,000–16,000 ft.; f. *goringense*? and f. *albidum*, 12,000–15,000 ft.

Range: The whole species ranges from the Western Himalayas through southern and central Tibet and Nipal to Yunnan, Szechuan, and Kansu: f. *Ellisii* is found in Western Himalayas, southern Tibet, and Szechuan; f. *goringense* in southern and central Tibet; f. *albidum* is known only from Kansu.

Forma MAXIMOWICZII.

W.H.: *Lace* 1755; *Thomson* s. n., 4; *Edgeworth* 146; *Jacquemont* 1774; *Stewart* 1802; *Coventry* 943; *Lacoste* s. n.; *Heyde* s. n., *Watts* 3133, 2484; *Drummond* 22171 *pp*; *Ellis* 1563; *Brandis* 3922, s. n.; *Schlagintweit* 1700; *Duthie* 835, 835 *a*, 25663, s. n.

N.: *King's collector* s. n.

S.T.: *Kingdon Ward* 6022; *Strachey & Winterbotham* 4; *Wollaston* 125; *Everest Exped.* 384, 385; *Younghusband* 182; *Littledale* s. n.; *King's collector* s. n.

Y.: *Rock* 10036.

S.: *Limpricht* 206.

K.: *Ching* 666, 742: *Licent* 4652; *Pelliot-Vaillant* 916; *Farrer* s. n.; *Prjewalski* s. n. (type of species).

Forma ELLISII.

W.H.: *Duthie* 13371; *Ellis* 381; *Thomson* s. n.; *Watson* s. n.; *Collett* 179.

T.: *Forrest* 20326, 20412.

S.T.: *Ludlow* 146.

S.: *Wilson* 3794.

K.: *Prjewalski* s. n.

Forma GORINGENSE.

S.T.: *Thorold* 75; *Littledale* s. n.; *Sven Hedin* s. n.; *Wellby & Malcolm* s. n.; *Deasy & Pike* 864.

Forma ALBIDUM.

K.: *Farrer* 7, 587.

One of the commonest and most widespread species in the genus. The typical form is found more or less over the whole specific range: forma *Ellisii* seems to be an ecological form; forma *goringense* is the form of the true Tibetan plateau, and forma *albidum* is an anomalous form found only in one region.

I am unable to distinguish either *C. Fletcheri* or *S. paberensis* from the true *plantagineum*, and they are therefore not maintained here. According to the Kew annotated copy of Comp. Indicæ, already mentioned under *C. oblongatum*, var. *β* of the printed page is *Ligularia frigida* Sch. Bip.

Wilson 3794 is a particularly luxuriant and handsome f. *Ellisii*, with very long ligule. It clearly shows relationship to *C. stenactium* Diels, and may, indeed, be a hybrid between that species and the above.

38. C. STENACTIUM Diels in Beih. Fedde Rep. xii (1922), 510.

Stem glabrous below, araneose hairy above, up to 90 cm.? *Radical leaves* not seen, but apparently ovate acute, subsessile, cuneate at base, shallowly dentate. *Cauline leaves* sessile, ovate, acute, glabrous, rather numerous, almost touching. *Capitula* solitary, very large, hemispherical. *Phyllaries* lanceolate, long acute, velvety along the middle, about 20–30 mm. long, with several ovate semi-scarious bracts outside them. *Disc-florets* yellow, upper 3/5 cylindric campanulate. *Ligulate florets* yellow, very long, up to 8 cm., ligule four or five times as long as the tube, linear ligulate, deeply toothed. *Pappus* white.

Habitat : No information, no altitude given.

Range: Known from S.W. Szechuan only.

S. : *Limpricht* s. n. (type).

Probably the largest-flowered species in the genus, but unfortunately known only from the single incomplete type-specimen without radical leaves.

It is of interest in forming a connection between *C. Helianthus* and *C. suave* and the rest of the genus in the semi-scarious bracts outside the phyllaries. There are, however, only a few of them, and they do not form a complete involucre.

39. C. HELIANTHUS (Franch.) W. W. Sm. in Notes Roy. Bot. Gard. Edin. xiv (1924), 289.

Senecio Helianthus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 286.

Stem glabrous and glaucous throughout, up to 45 cm. *Radical leaves* shortly petiolate, ovate elliptic, subentire, glabrous on both surfaces. *Cauline leaves* few and distant, or more usually several and overlapping sessile, lanceolate entire. *Capitula* large, hemispherical, with an outer involucre of broadly lanceolate green bracts. *Phyllaries* variable, narrow to broad lanceolate, long acute, glaucous, c. 15 mm. *Disc-florets* yellow, upper 2/3 subcylindric campanulate. *Ligulate florets* yellow, tube variable, ligule very long linear, rather broader below and deeply toothed. *Pappus* white.

Habitat : Open alpine meadows ; stony meadows and calcareous rocks; screes and cliffs, 12,000–14,000 ft.

Range : Extreme N.W. Yunnan and S.W. Szechuan.

Y. : *Forrest* 10391, 10916, 12798, 21971, 22285, 22637, 25711, 25881 ; *Delavay* 3858 (type) ; *Handel-Mazzetti* 4536.

S. : *Forrest* 16823, 16993.

A species with very strong fragrance. This and *C. suave* are at once identified by having an outer involucre of ovate bracts. They are connected with the rest of the genus by *C. stenactium*, which has one or two outer hyaline bracts but not a complete involucre.

40. C. SUAVE W. W. Sm. in Notes Roy. Bot. Gard. Edin. xii (1920), 203.

Stem glabrous and glaucous throughout, up to 45 cm. *Radical leaves* rather long petiolate, linear elliptic, acute, subentire, glabrous. *Cauline* leaves usually few and not overlapping, lanceolate, sessile. *Capitula* large, hemispherical, with an outer involucre of ovate lanceolate acute green bracts. *Phyllaries* narrow lanceolate, long acute, glabrous. *Disc-florets* greenish-orange, upper 3/5 rather broadly cylindric campanulate. *Ligulate florets* orange-yellow, ligule about six times the tube, lanceolate linear, deeply toothed. *Pappus* white.

Habitat: Limestone cliffs; ravines and ledges; open stony and alpine pastures on the margins of pine forests, 10,000–15,000 ft.

Range : Known from extreme S.W. Szechuan only.

S.: *Forrest* 16796 (type), 17010, 21388, 22122; *Kingdon Ward* 4498, 4619 ; *Handel-Mazzetti* 7146.

Very closely related to *C. Helianthus*, but the differences are quite constant, and although the distributions overlap, I have seen no intermediates. In *C. suave* the leaves are much narrower, the cauline leaves fewer, and there are differences in the corollas of both disc and ligulate florets.

41. C. ANGUSTIFOLIUM W. W. Sm. in Notes Roy. Bot. Gard. Edin. xii (1920), 200.

Stem glabrous below, lanate-hairy above, up to 45 cm. *Radical leaves* subsessile, narrow linear lanceolate, acute, glabrous, entire. *Cauline leaves* similar, linear lanceolate to linear subulate. *Capitula* large-medium, solitary, hemispherical. *Phyllaries* relatively numerous, linear lanceolate acute, lanate-hairy, black-crimson. *Disc-florets* orange, upper 2/3 cylindric campanulate. *Ligulate florets* none. *Pappus* dirty white.

Habitat : Open stony pastures and earth screes on grassy hillsides, 12,000–14,000 ft.

Range: Extreme N.W. Yunnan and S.W. Szechuan.

Y.: *Forrest* 10653 (type), 12809 ; *Handel-Mazzetti* 7712.

S.: *Rock* 6485 ; *Soulié* 363 ; *Kingdon Ward* 4424.

The very narrow leaves and discoid heads distinguish this species from the rest of the genus.

42. C. PINNATIFIDUM Benth. in Hook. Icones Pl. xvii (1887), 1142.

Senecio himalayensis Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 287.

Stem glabrous below, black-hairy above, up to 25 cm. *Radical leaves* petiolate, petioles with conspicuous vaginæ, elliptic in outline and completely pinnatisect, glabrous on both surfaces, paler below. *Cauline leaves* absent or reduced to a single bract. *Capitula* medium, solitary, hemispherical. *Phyllaries* about 10 mm. long, narrow lanceolate acute, black-pubescent. *Disc-florets* yellow, upper 5/6 narrow cylindric. *Ligulate florets* yellow, tube very short, ligule narrow oblong, truncate, deeply dentate. *Pappus* white.

Habitat: Peaty turf covering boulders in exposed positions, 13,000–14,000 ft.

Range: Known only from Sikkim and adjacent Tibet.

Sk.: *Cooper* 591, 809; *Hooker* s. n. (type).

S.T.: *Wollaston* 126.

Except for the leaves this species is very like the species of the *C. Thomsoni* affinity. It appears to be a local and rare species.

43. C. DISCOIDEUS Max. in Bull. Acad. Peters xxvii (1881), 483.

Senecio discoideus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 284.
Cremanthodium cuculliferum W. W. Sm. in Rec. Bot. Surv. India, v (1911), 209.

Stem glabrous below, white-woolly mixed with black hairs above, up to 25 cm. *Radical leaves* long petiolate, elliptic to ovate oblong, acute, truncate at the base, subentire, the larger somewhat rugose. *Cauline leaves* sessile, elliptic acute. *Capitula* small-medium, solitary, campanulate. *Phyllaries* lanceolate, acute, black-villose, about 10 mm. long. *Disc-florets* very narrow funnel-shaped, scarcely divisible into tube and upper part. *Ligulate florets* none. *Pappus* white.

Habitat: High alpine meadows, 10,000–17,500 ft.

Range: Sikkim and W. Kansu.

Sk.: *Smith & Cave* 1956.

K.: *Prjewalski* s. n. (type); *Licent* 4423; *Ching* 667.

I am unable to see any reason for maintaining *C. cuculliferum* as a distinct species. It has somewhat larger leaves and its geography is different, but there is no structural character to separate it, and I have therefore included it under *C. discoideum*.

44. C. PSEUDO-OBLONGATUM R. Good, sp. n.*

Stem entirely glabrous, up to 45 cm. *Radical leaves* petiolate, petioles minutely winged and vaginate at the base, oblong elliptic subacute, base truncate, entirely glabrous. *Cauline leaves* 4 or 5, sessile, elliptic to linear, not touching one another. *Capitula* solitary, medium-large, hemispherical. *Phyllaries* narrow lanceolate, long acute. *Disc-florets* upper 3/4 subcylindric. *Ligulate florets* yellow, tube short, ligule lanceolate, gradually narrowed to the deeply 3-dentate tip. *Pappus* white.

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* *Herba* mediocris usque ad 45 cm.; *radicibus* crassis; *caulibus* striatis tote glabris, basi reliquiis fibrosis petiolorum cinctis; *foliis radicalibus* petiolatis, petiolis c. 3 cm. minute alatis basi vaginatis, oblongis ellipticis ad 6×3·5 cm. basi truncatis, integris vel subdentatis, utrinque glabris; *foliis caulinis* plerumque 4–5, sessilibus ellipticis vel linearibus non caulem obtegentibus; *capitulis* solitariis majusculis hemisphæricis ad 6 cm. in diam.; *phyllariis* anguste lanceolatis longe acutis c. 10 mm. longis; *floribus discoideis*, parte 3/4 supero cylindraceo subcampanulato; *floribus ligulatis*, luteis, tubo breve ad 2 mm., ligulis lanceolatis apice elongatis profunde 3-dentatis, c. 8-venis, ad 2 cm. longis; *pappo* albo c. 7 mm.

Habitat : No information, 10,000–17,000 ft.

Range : Western Himalayas, Sikkim, and S. Tibet.

W.H. : *Duthie* 3067.

Sk. : *Lepcha* 505 ; *Dungboo* s. n.

S.T. : *Kingdon Ward* 5931 (type); *Everest Exped.* 356.

This species has hitherto been confused with true *C. oblongatum*, but it is perfectly distinct not only in foliage, but also in the proportions of the floral parts. It seems to be a rare plant, because, although its range is extensive, it has been very little collected.

45. C. BUPLEURIFOLIUM W. W. Sm. in Notes Roy. Bot. Gard. Edin. viii (1913), 112.

Stem glabrous below, very slightly araneose above, up to 40 cm. *Radical leaves* long petiolate, elliptic ovate, bluntly acute, glabrous, subentire or dentate. *Cauline leaves* sessile, oblanceolate to ovate, scarcely clasping. *Capitula* medium size, solitary, hemispherical. *Phyllaries* lanceolate acute, glabrous except for the araneose base. *Disc-florets* upper 4/5–5/6 subcylindric campanulate. *Ligulate florets* yellow, tube obsolete, ligule lanceolate elliptic to linear lanceolate, with about 5 veins. *Pappus* absent.

Habitat: In scrub, alpine grasslands, and stony pastures, 13,000–14,500 ft.

Range : Extreme S.E. Tibet, N.W. Yunnan, S.W. Szechuan.

T.: *Forrest* 14590.

Y.: *Forrest* 13228, 19594 ; *Kingdon Ward* 75 (type), 968 ; *Rock* 9293, 9405, 10026.

S.: *Forrest* 16507.

Reminiscent of *C. nobile* in the foliage and also of *C. pseudo-oblongatum*, but at once distinguished by the absence of the pappus as well as by numerous smaller characters. This species has been grown at Kew.

46. C. VARIIFOLIUM R. Good, sp. nov.*

Stem glabrous below, woolly-pubescent above, up to 20 cm. *Radical*

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* *Herba* parva usque ad 20 cm.; *radicibus* crassis; *caulibus* supra lanato-pubescentibus basi reliquiis fibrosis petiolorum cinctis; *foliis radicalibus* petiolatis, petiolis ad 5 cm. crassis

leaves very variable in size, petiolate, elliptic, ovate-obovate, subacute, cuneate at the base, subentire, glabrous on both sides, petioles with scattered minute black hairs. *Cauline leaves* numerous, entire, lanceolate to linear subacute. *Capitula* solitary, medium-large, hemispherical. *Phyllaries* lanceolate, acute, subglabrous, often purple. *Disc-florets* greenish-orange, tube very short, upper part very narrow subcylindric campanulate. *Ligulate florets* orange-yellow, ligule five to six times as long as the tube, elliptic minutely truncate dentate. *Pappus* white.

Habitat: Open screes and ledges of cliffs and open stony pastures, 12,000–15,000 ft.

Range : Extreme S.E. Tibet and adjacent Yunnan.

T.: *Forrest* 14442, 14871, 19042, 19976, 20237.

Y.: *Forrest* 14668, 14699 (type), 20728.

This species has often been confused with *C. oblongatum*. The chief characters are in the very variable size of the leaves, their elliptic subentire shape and pinnate venation, and the numerous entire cauline leaves which touch or overlap.

47. C. HUMILE Max. in Bull. Acad. Peters. xxvii (1881), 481.

Senecio kansuensis Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 287.

Cremanthodium comptum W. W. Sm. in Notes Roy. Bot. Gard. Edin. viii (1914), 184.

Stem glabrous below, but covered with multicellular black hairs above, up to 20 cm., usually much less. *Radical leaves* long-petiolate, ovate, shortly cuneate below to suborbicular, with few large teeth, glabrous above, white tomentose below. *Cauline leaves* petiolate, elliptic to linear, dentate, tomentose below. *Capitula* very variable in size, solitary, semi-cernuous, and usually of middle size. *Phyllaries* linear lanceolate, villose, with black and white hairs. *Disc-florets* almost regularly subcylindric conical. *Ligulate florets* yellow, ligule three to four times as long as the tube, oblanceolate elliptic. *Pappus* white.

Habitat : On limestone screes, cliffs, and among loose rock ; on open stony and alpine pasture and moorland.

paucis pilis nigris parvis obtectis, ellipticis vel ovatis vel obovatis pinnato-venatis, subintegris utrinque glabris ad 2-12 cm. longis, 1·5-7 cm. latis; *foliis caulinis* numerosis plerumque caulem totam obtegentibus integris lanceolatis vel linearibus subacutis; *capitulis* mediocribus ad 5 cm. in diam. solitariis hemisphericis; *phyllariis* c. 11 mm. longis lanceolatis acutis subglabris sæpe atropurpureis; *floribus discoideis* viridi-aurantiis tubo brevissimo, parte supero angustissime subcylindraceo campanulato; *floribus ligulatis* aurantiis, ligulis quam tubis 5-6-plo longioribus ellipticis minute truncatis dentatis; *pappo* albo.

Range : S.E. Tibet, N.W. Yunnan, Szechuan, and Kansu, 14,000–16,000 ft.

S.T. : *Kingdon Ward* 5987.

T. : *Forrest* 14716.

Y. : *Forrest* 13239, 19893, 20156 (very large), 20167, 20396 (very large) ; *Kingdon Ward* 975 ; *Rock* 10353, 10354 ; *Gregory* s. n.

S. : *Kingdon Ward* 5331.

K. : *Farrer* 683 ; *Licent* 4646 ; *Prjewalski* s. n. (type).

Remarkable for the great variation in the size of its heads. They are usually about one inch long, but sometimes they are among the largest in the genus. The habit varies too, but not to the same extent.

48. C. NANUM (Decne) W. W. Sm. in Notes Roy. Bot. Gard. Edin. xiv (1924), 118.

Cremanthodium Deasyi Hemsl. in Journ. Linn. Soc. xxxv (1902), 184.
Senecio sessilifolius Sch. Bip. in Flora, xxviii (1845), 50.
Werneria nana Benth. in Gen. Plant. ii (1873), 1, 451.
Ligularia nana Decne in Jacquem. Voy. Bot. (1844), p. 41, tab. 99.
Senecio Clarkeanus Franch. in Bull. Soc. Bot. Fr. xxxix (1892), 288.

Stem very stout, glabrous below, densely woolly above, up to 10 cm. *Radical leaves* thick, long-petioled, ovate to suborbicular, entire, lamina very small. *Cauline leaves* few, thick, ovate oblong, semi-clasping. *Capitula* medium, solitary, erect or rarely semi-cernuous. *Phyllaries* oblong, obtuse, densely black or grey-woolly. *Disc-florets* yellow, more or less narrow conical throughout. *Ligulate florets* yellow, ligule twice the length of the tube, broad elliptic, rounded at the tip. *Pappus* white.

Habitat: On open stony slopes and pastures; on screes and among loose fragments of rocks, 14,500–18,500 ft.

Range: From the Western Himalayas through Sikkim to S. and S.E. Tibet and extreme N.W. Yunnan.

W.H. : *Jacquemont* 1121 ; *Clifford* 131.

Sk. : *Lepcha* 338 ; *King's collector*, s. n.

S.T.: *Younghusband* 227 ; *Strachey* & *Winterbotham* 3; *Thorold* 33 ; *Deasy* & *Pike* 827, 841.

Y. : *Forrest* 14517, 19830.

A very dwarf species in which the heads are usually erect because the stems above the ground-level are very short. This species probably reaches higher altitudes than any other species.

Species excluded from *Cremanthodium* :—*C. calotum* Diels = *Aster* sp.

II. GEOGRAPHY.

INTRODUCTION.

A combination of two methods, neither of which is entirely satisfactory alone, has been used below to illustrate the geography of the species. The first method is that of plotting all the occurrences as far as their localities can be determined. The second method is to indicate, by a continuous outline, the areas within which the known occurrences are spread. The first of these methods is, theoretically, the ideal one, and exactly illustrates the sum total of knowledge of the distribution of any given species. The second method is not so reliable, since it needs must include at least some areas over which the plant has not actually been found. On the other hand, the first method cannot easily be made to represent more than one area on any map, unless some rather complex method of colouring or shading is used, and this is a point of considerable practical importance, while it is also very much more difficult to compare the ranges of species shown in this way. For these reasons it was thought that the best results would be obtained by using both these methods.

Pl. **9** is an outline map of the whole continent of Asia on which is shown in black the total area of the genus *Cremanthodium* as depicted by the second method, so as to show its relation with the Arctic on the one hand and the tropics on the other. Pl. **11** shows the detailed range of the genus determined by the first method, all known occurrences being, as far as possible, included. Pl. **12** is a map of the generic area on which, by method two, the areas of all the species *except* the narrowly endemic Chinese ones have been drawn. The drawback to this method is well seen in the difficulty of following the different outlines in congested parts of the map. This map is, however, specially designed to show the sum totals of the distributions, and for this purpose serves satisfactorily: it should not be used for the elucidation of individual specific areas without the help of Pl. **9** and of the details given in the taxonomic part of the paper. Pl. **12** shows on a much larger scale that area called, for convenience, S.W. China, although comprising parts of Tibet and Burma, in which are found nearly all the narrow endemics of the genus. Its comparative area is indicated by the dotted lines on Pl. **11**. This large-scale map again illustrates the second method; but here, owing to the increased size, the effect is much better and the outlines are easily followed. All the last three maps are river maps, these being the only features shown, because it is in terms of river systems and valleys that the geography of *Cremanthodium* is best described. The two smaller-scale maps are after Burrard and Hayden in the 'Geography and Geology of the Himalayan Mountains and Tibet' and the larger-scale map from that illustrating Kingdon Ward's paper, "From the Irrawaddy to the Yangtse," in the 'Geographical Journal,' vol. lxii, p. 9, 1926.

Pl. **11** requires a special word of explanation. It will be seen at once that the records are by no means equally scattered, but are specially massed in certain spots. This is because these spots are those most often visited. In Sikkim, for instance, it has actually been impossible to insert every record, simply on account of lack of space for the dots. As it is, the true political boundaries have been exceeded. Similarly, in parts of S.W. China, and particularly in the Likiang snow range in the Yangtse bend, the collecting has been specially plentiful. On the other hand, certain parts of the area, such as Bhutan and Nipal on the west and N.W. Szechuan and N.E. Tibet on the east, are still almost unexplored. This indirectly causes an unsatisfactory feature in Pl. **11**, namely the position of Sikkim as an apparent specific limit of importance. This is probably quite misleading, but at present unavoidable. Further collecting will no doubt show that the actual limits eastwards of certain western species are somewhere in Bhutan or east of it, while the limits westwards of certain eastern species are somewhere in Nipal. Such limitations in the pictorial value of the maps must be remembered when they are being studied.

TOPOGRAPHY.—The area of the genus *Cremanthodium* is roughly that of the triangle made by joining the three points 35°/75°, 35°/105°, and 25°/100°. This area contains within it two mountain systems. One, comprising the Himalayas, is long and narrow, convex towards the south, and runs mainly W.N.W.-E.S.E. The other, comprising the Tibetan-Chinese-Burmese mountains (together spoken of below as the Chinese mountains), is shorter but much broader, and stretches almost due north and south. The former system meets the latter almost at right angles some little distance below the centre. By this two angles are formed—one north of the Himalayas containing parts of the great Tibetan plateaux, and the other south of the Himalayas containing the plains of Bengal, the hills of Assam, and the basin of the Irrawaddy. Certain other points distinguish the two mountain systems besides their direction and width. The Himalayas are, on the whole, higher than the Chinese mountains. The latter are highest opposite the Himalayas, and in that region have quite comparable elevations, but to the north and south they diminish. Again, the Himalayan chain is not intersected by any great rivers rising from the main Tibetan plateau. Its two largest waters, the Indus and the Brahmaputra, arise near one another only just to the north of the mountains, and thence flow in opposite directions to and round the ends of the chain and thus to the sea. It is quite true that the valley of the Indus does not mark the end of mountains, but those beyond, the Hindu Kush and the Kashgar and Karakoram ranges, are not part of the true Himalayan chain. To the east of the Brahmaputra are the Chinese mountains. These are traversed by four rivers of the first magnitude, all with their sources far away in the main plateau of Tibet, and all converging to pass through the mountains in roughly parallel gorges at no great distance apart. Further to the east they once more diverge, and reach the sea at different points between the north coast of China and the Gulf of Martaban. The region of these gorges is also the region of highest elevation, and it is only here that extensive permanent snow-peaks are found east of the Himalayas proper. Another difference between the western and eastern mountains is that the former rise on the south side suddenly from almost sea-level, forming the most spectacular mountain barrier in the world. The eastern mountains, on the contrary, pass gradually to lower levels towards the east till they become almost lost in the lesser relief which covers the greater part of China.

To paraphrase the above. The great elevated plateau of Tibet is bounded on the south and east by a great branched mountain rampart in which the southern arm is longer, narrower, higher, slightly curved, and rises from sea-level, while the eastern arm is shorter, broader, rather lower, produced towards the south, and very gradually falls away towards the east. Further south these eastern mountains pass imperceptibly into the backbone of the Malay Peninsula and Archipelago.

From a slightly different point of view the generic area of *Cremanthodium* may be divided topographically into three zones : (1) the Himalayan Mountains between the Indus and the Brahmaputra ; (2) the Chinese-Tibetan-Burmese mountains east of the Tibetan plateau, the Brahmaputra, and the Irrawaddy ; and (3) the Tibetan plateau itself.

The political boundaries bear scarcely any relation to the topography except slightly in the west, and they are therefore neglected in the maps.

GEOLOGY.—Our knowledge of the geology of the area described above is still very incomplete, especially as regards the Chinese and Tibetan parts. At the same time, it is only the broader features which directly concern the plant distribution, and these are fairly well known.

Between the western and eastern mountain systems there are considerable differences in geological history and structure which may be briefly summarized here. The peninsula of India is one of the oldest land surfaces of the earth—that is to say, it has been for an exceedingly long period above the surface of the sea. The valleys of the Ganges and the Indus and the Himalayan mountains themselves are among the newest land surfaces. The presence in the mountains of marine beds of early and middle Tertiary date indicate that it was only after that time that the land rose above the sea, and although there are comparatively old rocks in parts of the system, they are overlain by these much more recent marine sediments. In short, it may be considered that the Himalayas arose or began to arise (the process may still be continuing) not earlier than the middle Tertiary, and that before that time there were no western mountains of considerable elevation.

In China, on the other hand, there is evidence that the mountains are of much more varied date and extend over a much longer period of geological history. The present snow-peaks and the highest altitudes have probably the same age as the Himalayas and are most probably part of the same uplift, but other parts of the mountains are much older and represent earlier, more denuded mountains. Unlike the western mountains, there is no clearly defined time limit before which it is possible to imagine the entire absence of mountains. Some of the Chinese mountains, and especially those with the highest altitudes, seem to indicate an extension of the Himalayan range to the east, but the exact direction of this is still a matter of contention. The older mountains, or at least some of them, are represented by the arc of elevated land passing down through the Malayan Peninsula, Sumatra, and Java. The theoretical importance of these differences between the two mountain systems from the botanical point of view is obvious. As far as can be told, there have been mountains of considerable elevation in western China throughout the geological history of the Angiosperms, but the mountains of the west originated only in the latter half of this period. With the mountains beyond the Indus this paper is not concerned, and, whatever their history may be, their botanical relationships have no bearing on *Cremanthodium*. At the time of the Pleistocene glaciation it is presumed that the main relief of Asia was as it is to-day, and since that time the level of the ice has been steadily rising and the areas of permanent snow as steadily diminishing.

METEOROLOGY.—As with the geology, so the meteorology of the generic areas is fairly accurately known as regards the Indian part, but very imperfectly as regards the Chinese and Tibetan. The only feature which it is necessary to discuss here is the rainfall. In the topographical sketch the rampart-like nature of the two mountain systems was emphasized, because it is to this character that the main features of the precipitation are due. The two mountain masses, meeting at nearly a right angle, lie across the path of the south-west monsoon, which blows from April to October, in such a way as to form a funnel-like angle into which the moisture-laden winds blow. The result of this great barrier is an exceedingly heavy rainfall on its immediate southern side—a rainfall in some places higher than anywhere else in the world. The width of this very high rain zone extends from about eastern Nipal to Upper Burma. In all directions from here the rainfall decreases at varying rates. Right to the western end of the Himalayas it continues high—almost approaching that of the maximum zone ; but northwards from the mountains it decreases very rapidly, and the northern slopes are much drier than the southern. A great part of the Tibetan plateau has less than 8 inches of rainfall every year, and hence is a semi-desert. On the Chinese side the gradient of decrease is much more gradual and the successive zones are wider. They are also much wider in the south than in the north, so that finally the isohyets come to run approximately due east and west. The practical result of these differences is that in the western Chinese mountains, and especially the southern portion of them (with which this paper is chiefly concerned), there is a rather sharp line of maximum precipitation, the so-called rain screen, near the Chinese-Burmese frontier, and eastwards and northwards from there the rainfall gradually lessens. The rough outlines of several isohyets illustrating this are superposed on the first map. From the point of view of *Cremanthodium* a considerable part of the generic range is within the zones of higher precipitation, and here also the species population is much greater than elsewhere.

GENERIC DISTRIBUTION.—The total generic range of *Cremanthodium* is shown in detail on Pl. **11**. The area is roughly a right-angled triangle in which the two shorter sides follow the mountain axes, and the hypoteneuse runs diagonally across the plateau of Tibet; but the regularity of this figure is spoilt by the extension of one species into the mountains of Shensi, well to the east of the rest of the genus. The sides of this triangle are about 1700, 1600, and 800 miles long, and the whole area enclosed is about 650,000 square miles, or some five times that of the British Isles. On the south-west the generic limit is a topographical one—the valley of the Indus. No records are known from beyond it, and this is perhaps correlated with differences of history between the mountains on the two sides of it. The extreme northern limit is just east of Lake Koko Nor, and the southern limit just includes Lake Tali in Yunnan. It is probable that further exploration and collecting will modify these boundaries in many directions, more especially on the east and north. The western limit is probably fairly accurately known.

PROPORTIONAL DISTRIBUTION OF THE SPECIES.—A glance at Pls. **12** and **13** shows that the species are distributed very unevenly over the generic area, and in three directions the range of a single species, different in each case, very much modifies the total effect. These are on the Tibetan plateau, the Assam Hills, and in Shensi, in each of which only a single species is known. The total number of species is 48; of these, 3 have 2 subspecies and several have one or more forms.

The general distribution may be indicated first by the specific populations of the three main topographical regions of the genus. The Tibetan plateau has 2 non-endemic species; the Himalayas have 18 species, of which 4 are endemic; and the Chinese mountains have 44 species, of which 30 are endemic. This brings out the important point that the first two areas, together much the greater part of the genus area, have only 4 species out of 48 confined to them. It also follows that 14 species are found in both eastern and western mountains, this being a very large proportion of the species not endemic to the east.

Additional details appear when the analysis is carried further. If political boundaries are used for convenience, the results are as follows :—

N.W. Yunnan......	30 species.	Kansu...............	8 species.
S.W. Szechuan ...	20 ,,	W. Himalayas ...	6 ,,
S.E. Tibet	14 ,,	(Bhutan............	5 ,,)
S. Tibet	14 ,,	(Nipal	3 ,,)
Sikkim	13 ,,	Assam	1 ,,
Burma	9 ,,	Shensi	1 ,,

The figures for Bhutan and Nipal are given in brackets because, owing to the small amount of collecting done in these countries, they are almost certainly too small. Excluding them, the table shows that the population numbers decrease from N.W. Yunnan, both eastwards along the Himalayas and northwards into Kansu. The centre of the genus thus lies in the region of the deep gorges of the Salween, the Mekong, and the Yangtse, and is mostly in N.W. Yunnan, but also includes small parts of adjacent S.E. Tibet and S.W. Szechuan. In this region, which may for convenience be considered as between 98° and 103°·5 East longitude and between 25° and 31° North latitude, and which is only about 1/5 the genus area, are found 44 species out of a total of 48.

Considering the different history and structure of the two mountain ranges, it might reasonably be supposed that there would be some segregation in the distribution of the species over them, but *Cremanthodium* shows no such feature. The species of the genus may be treated as belonging to three categories : *wides* or species occurring in at least two of the three main topographical regions, *endemics* or species confined to one such region, and *unique* endemics known at present only from a single collecting or locality. Such is an arbitrary classification, and it must be remembered that endemic is a relative rather than a strict term, and must always be used in association with some geographical limitation. *Cremanthodium* itself is entirely endemic to the Himalayan-Chinese mountains, but it contains a number of species endemic to more limited areas.

WIDE SPECIES.—The wide species number 14, and the most widespread of all is *C. plantagineum*. It is one of the two species found on the Tibetan plateau, and it also reaches the extreme western and northern limits of the genus. It is not found south of latitude 28°, but, apart from this, it occurs throughout the genus range. Correlated with this wide range is considerable structural variation, and it has been necessary to subdivide the species into four forms. One of these is a giant form, probably an ecad, occurring in the damper and warmer parts and having much the same range as the typical form, which itself has the area of the species except that it is absent from the Tibetan plateau. Here its place is taken by the form *goringense*, which differs in having a rather smaller head arranged cymosely. Conversely, this form is not found south of the basin of the Brahmaputra. The fourth form is found only in Kansu and has been rarely collected. It is worthy of note that both these latter forms are found on the edges of the specific range.

In actual point of distance between records, *C. oblongatum* is the second largest species in the genus ; but this species is taxonomically very unsatisfactory and exceedingly variable, so that its range, as given here, must be treated with caution. It is mostly Himalayan and centred in Sikkim, but there is also a single record from the Western Himalayas. The other localities are in Kansu, but these specimens differ in having several heads arranged racemosely. In many features, however, they are undoubtedly indistinguishable. It may be mentioned in passing that such a broken distribution is not unparalleled in the genus, and other examples will be referred to later. The next species, *C. Decaisnei*, has on a somewhat smaller scale a rather similar distribution. Except for one specimen it is exclusively Himalayan, ranging from Kashmir to Sikkim. This single specimen was collected in Yunnan, and differs from the typical *Decaisnei* in one definite character, the absence of a tube in the ligulate corollas. In many other ways it is exactly like true *Decaisnei*, and there can be little reason for doubting their community of origin.

C. arnicoides, in which is included *C. scytophyllum* of Diels, has a very similar range and shows the same kind of disjunction between Sikkim and Yunnan, except that there is a single record for southern Tibet. *C. scytophyllum* appears to have been established on a very glabrous plant from a comparatively dry habitat, and, as might be expected, such plants occur in Yunnan and not in the Himalayas. Two other species, *C. retusum* and *C. nanum*, range from Kashmir to Yunnan. The first is a large and handsome plant. The second is a tiny dwarf with a stem so short that the solitary heads are necessarily erect. In range, as in stature, it is rather anomalous, and is the second species found on the main Tibetan plateaux, but in the western part only, and much more restricted than *C. plantagineum*. *C. retusum* also shows an anomaly in the single record from the Naga Hills of Assam.

The remaining wide species are not found farther west than Sikkim. Three of them are found also in Yunnan, Szechuan, and Kansu, so that their distribution when plotted is in three discontinuous patches. This is probably largely correlated with the paucity of collections from the intervening districts. *C. Hookeri*, the first to be mentioned, is peculiar in several ways. Geographically it is responsible for the irregular extension of the genus into Shensi, where it has been collected at least twice in the mountains.

Taxonomically it is quite the most puzzling and difficult species in the genus. Even its classification into two subspecies and a number of forms, as has been done here, scarcely expresses its polymorphy adequately. It has been collected far more than any other species, and probably may be considered one of the most plentiful. In the Himalayas it occurs only in Sikkim and adjacent parts, but in western China it ranges from the south almost to the northern limits of the genus. The ranges of the two subspecies are much alike, and each covers the specific area, except in Shensi, where both the specimens collected belong to subsp. *Clarkei*. Similarly, two of the five forms are found in both mountain systems, but three others are confined to one or the other. Two of them are known only from single specimens. As explained in the first part of the paper, *C. Hookeri* is very like certain few-headed forms of *Ligularia* spp., and probably represents one of the connections of *Cremanthodium* with that genus. Another of the three species, *C. plantaginifolium*, although different in all essentials from *C. Hookeri*, not only has a very similar range, but also has to be classified on very much the same lines. In both species the subspecies depend upon the number of capitula, and the forms upon the more detailed arrangement of the capitula. This striking similarity between two species by no means nearly related is remarkable, and invites the suggestion that variation and subsequent evolution proceeds within this plant affinity along certain definite lines. In geography this species differs from *Hookeri* in that it does not reach Shensi and also that it has its Kansu localities rather farther north. One of the two subspecies is a very rare one confined to Kansu and rather recalling the Kansu form of *C. plantagineum*. The forms of the other subspecies are not geographically segregated to any significant extent. The third species, *C. Thomsoni*, shows similar characteristics in modified form. It has not been thought necessary to subdivide the species taxonomically, but the single Kansu representative of the species is distinctly anomalous in the hairs on the phyllaries and in the toothing of the leaf. In addition to the Sikkim, S.W. China, and Kansu regions, this species has also been collected in the north-east bend of Brahmaputra. The Chinese specimens are, as a rule, much more coriaceous and subfleshy than the eastern ones, and this, again, is perhaps correlated with the climatic differences between the southern slopes of the Himalayas and the mountains of China.

There is still one wide species to mention whose western limit is in Sikkim. This is *C. discoideum*, and its range is the most remarkable in the genus. Its type-locality is in Kansu, where it has been collected several times; but there appears to be absolutely no significant difference between these plants and those collected in Sikkim and described under the name of *C. cuculliferum*. The species is most distinct in facies from any other species of the genus, and there is not likely to be any such confusion. In structure the plants from

Kansu and Sikkim are exceedingly alike, and the only apparent difference between them is that the latter have larger leaf-blades than the former. This is probably only a reflection of climatic distinctions in the two regions. *C. discoideum* is thus known at present from Kansu and Sikkim (compare *C. oblongatum*, p. 287).

The next species, *C. palmatum*, is a most interesting one. Its total range is from Sikkim on the west to Yunnan and S.E. Tibet on the east, but the species divides both structurally and geographically into two perfectly clear-cut subspecies. In one of these the leaf-teeth are evenly shallow dentate, while in the other the leaves are variously palmatisect. Except in this character, there is apparently no difference within the species, and, moreover, the species as a whole possesses certain minor characters, such as peculiarities in the hairs possessed by only one other species in the genus (see *C. campanulatum* p. 310). Curiously enough, the Sikkim subspecies was the first to be described, but has ever since remained a rare and little-known species. The western subspecies was not described until 1912, but since then has become comparatively well known and widely represented in herbaria. Unfortunately, in uniting the two under one species it becomes necessary to maintain as the species name that of the first described. In this complete segregation of the two subspecies *C. palmatum* seems to carry rather farther the incipient disjunction seen in many of the species mentioned above. It is also noteworthy that the plant from the Brahmaputra bend belongs to the Chinese subspecies.

Two more species complete the tale of the wides. *C. humile* has been found in three separate regions: the Brahmaputra bend, in Yunnan, and in Kansu. It is a very variable plant in the size of the heads. The other species, *C. cremanthodioides*, has been found in Sikkim and Yunnan, and thus resembles *C. retusum*, a closely-related species.

Collections from the extreme East Himalayas between eastern Bhutan and the Namcha Barwha will undoubtedly fill up considerable gaps in our detailed knowledge of the distribution of many of these wide species. Until Kingdon Ward's expedition to the Tsangpo in 1925 practically nothing was known of the flora between Bhutan and the Salween.

HIMALAYAN ENDEMIC SPECIES.—The four species endemic to the western mountains all have rather different distributions. The widest is *C. pseudo-oblongatum*, with records from Garwhal, Sikkim, and the Brahmaputra bend. To this species belong several of the specimens previously identified as *C. oblongatum.* The next species in point of size is *C. reniforme*, the type-species of the genus. It extends from eastern Nipal to Sikkim and western Bhutan. Judging from the frequency of collection it seems to be comparatively plentiful in Sikkim. The third species, *C. pinnatifidum*, is a rare and remarkable species, known from two or three collectings in Sikkim and neighbouring S. Tibet. In the shape and cutting of the leaves this species stands quite alone, and it is not easy to suggest its phylogeny. Lastly comes *C. rumicifolium*, a very little-known plant, collected, I believe only once, near the Yam Dok Tso, just south of the Brahmaputra, in the longitude of Lhasa. It appears to have affinity with *C. arnicoides*, which ranges from Kashmir to Yunnan.

CHINESE ENDEMIC SPECIES.—Of the 30 eastern endemic species, 20 are more or less widely distributed in that region and 10 are, at present, unique endemics, known only from a single locality. Following the course adopted above, the former will be discussed first. It is convenient to begin with two species whose ranges differ markedly from any others. These are *C. lineare* and *C. Potanini*, and both are found in Kansu and in Szechuan. In the first, most of the records are from Kansu, and there is only a single collecting from north-west Szechuan; in the second, most records are from the Tatsien Lu district of Szechuan, but the species has been collected once in southern Kansu. *C. lineare* is one of the most easily-distinguished species in the genus, the linear leaves and long ligules giving it an unmistakable facies. *C. Potanini* has somewhat similar capitula, but the leaves are long-petioled with small hastate cordate blades.

All the rest of the eastern species are to be found entirely in the area of the great river gorges described above. The actual centre of greatest species population is in the Likiang snow-range in the eastern bend of the Yangtse, and here are found no fewer than 12 out of the 30 species. Two of these, *C. campanulatum* and *C. pleurocaule*, are exceptional in extending north-east well into Szechuan to the latitude of about 31°·5, where they just overlap the southern limits of the two species discussed above. A similar but less marked extension is shown by *C. angustifolium*, which gets as far north as 29°·5 At this latitude also are found two unique endemics, *C. stenactium* and *C. Prattii*. Apart from these 7 species, all the others of the eastern endemics are rigidly restricted to south of latitude 28°·5.

Attention was drawn above to the similarity between *C. palmatum* subsp. *rhodocephalum* and *C. campanulatum*, and this likeness is one of the most remarkable biological features in the genus. These two plant groups are exactly alike (and equally unlike other members of the genus) except in one very conspicuous point, namely that the former has ligulate and the second discoid heads. Such a difference is very natural, but the details here are unusual. The former has what has been called a suburceolate head in which the short phyllaries and the longer reddish ligules are slightly incurved. The latter also has a suburceolate head of comparable colour and size, but this is produced by the enlargement and coloration of the phyllaries, which equal both phyllaries and ligules of the other. Thus exactly the same biological condition seems to have been reached by two distinct methods. The phylogenetic relation of the two units is not very clear, but they are almost certainly closely related. It will be recalled that *C. palmatum* is one of the wide species, and that its subspecies *rhodocephalum* is restricted to the eastern half of the range except for one Tibetan record. The ranges of this subspecies and of *C. campanulatum* are thus similar over much of S.W. China, but the latter extends some distance farther towards the north-east.

C. campanulatum does not stand alone in the enlargement of its phyllaries, and there is a very closely-allied species, *C. Wardii*. It is much more local and is the species found farthest west in Burma, and the two specific ranges, although close to one another, do not actually overlap. *C. gracillimum*, a very rare species, has a distribution similar to that of *Wardii*, and these are the only species of the genus which are found west of the Nmai Hka. Their ranges astride this river are no doubt correlated with the increased rainfall in these mountains.

Very similar to these but running due south and north along the Salween-Nmai Hka divide are two species, *C. pulchrum* and *C. Farreri*, and the long axes of their areas almost exactly follow the rainfall line along the divide. The latter is a particularly large and beautiful species, and both are white-flowered (except when fading), the only white-flowered species in the genus. *C. Farreri* is related to the Himalayan *reniforme*. The extreme south-west corner of this region is comparatively rich in species, there being two others besides the four already discussed. One of these, *C. citriflorum*, is a unique endemic, but the other has a very unusual distribution in which the long axis runs nearly due east and west. This is *C. Delavayi*, the most southerly of the genus, and one of the few at all amenable to garden conditions in this country.

The phenomenon of species pairs is very common in *Cremanthodium*, and attention has already been directed to two such pairs, *C. palmatum* and *C. campanulatum* and *C. campanulatum* and *C. Wardii*. Another very conspicuous pair is *C. Helianthus* and *C. suave*; they are very closely related, and distinguished from other members of the genus in having outside the phyllaries an additional involucre of broad green bracts. The first-named has what may be considered a normal type of range, embracing the Likiang mountains and the Mekong-Yangtse divide, but extends actually further south than any other species, to just beyond the Tali lake. The second species, *C. suave*, has a more unusual distribution. Its western part is common with that of *C. Helianthus*, but the remainder is more to the east, more, in fact, than any other species of similar latitude. Yet another conspicuous pair is *C. plantaginifolium* and *C. pleurocaule*, very alike in general habit and appearance, but differing in the leaf venation. The latter is one of the wider Chinese endemics. Other pairs are *C. retusum* and *C. cremanthodioides*, *C. oblongatum* and *C. sino-oblongatum*, *C. Decaisnei* and *C. Principis*, and *C. Thomsoni* and *C. bulbilliferum*.

Two species predominantly of the Salween-Mekong divide are *C. bulbilliferum* and *C. variifolium*, while *C. Forrestii* is found on both sides of the Salween. The first is also found west of the Salween, but its range is entirely within that of *C. Thomsoni*, and it is possibly only a bulbilliferous form of that species. The distribution of *C. variifolium* resembles that of *C. Delavayi*, and this is the second species that ranges narrowly west and east. It is found on all three main river divides.

The remaining species of the wider endemics are all centred on the great bend of the Yangtse River, and most of them are distributed from here north-westwardly across the Mekong. There are three exceptions: *C. atroviolaceum*, confined to the Likiang range; *C. phœnicochætum*, found on both sides of the Yangtse; and *C. nobile*, with a long, narrow north and south range, considerably wider in the south.

The remaining Chinese species are all at present unique endemics, and until they have been more collected their distribution is not of very great theoretical significance. They are fairly evenly distributed and show no marked aggregation. The two Szechuan species have been already mentioned, but a third, *C. cyclaminanthum*, must be added for Muli. *C. gypsophilum* and *C. sino-oblongatum* are on the Likiang range in Yunnan, and *C. calcicola* is on the Chungtien plateau on the other side of the river Yangtse. One, *C. Principis*, is on the Salween-Mekong divide and three on the Salween-Nmai Hka divide, one, *C. citriflorum*, well to the south of the others (*C. atrocapitatum* and *C. acernuum*).

SUMMARY OF THE DISTRIBUTION OF THE SPECIES :—

1. There are forty-eight species in the genus; all are montane, and only two of them are found also on the Tibetan plateau.

2. There is a very great degree of continuity between the western and eastern parts of the genus, and fourteen species are found in both.

3. With one exception, these fourteen wides are all found as far west as Sikkim.

4. The greatest concentration of species is in the Chinese province of Yunnan and more particularly in the Likiang range, and the number of species decreases in all directions from here.

5. The species found in Kansu and in the western Himalayas are all among the most widely distributed.

6. All the species common to Kansu and Yunnan are also found in the Himalayas.

7. Only four species are endemic to the Himalayas; one is a unique endemic, and none of them occurs in the western half of these mountains.

8. The long axis of all the Himalayan species follows that of the mountains themselves.

9. Thirty species are endemic to the eastern, or Chinese, portion of the genus, and of these ten are unique endemics.

10. The distribution of only two species is entirely north of latitude 29° N.

11. One species is found in the mountains of Shensi.

12. Except for seven species west of the Salween, the distribution of the species is not directly correlated with the river divides.

13. The Salween-Mekong divide south of latitude 28° N. is poor in species.

14. A number of Chinese species show a narrow extension towards the north-east from a wider, more southerly distribution.

15. One species is at present known only from Sikkim and Kansu.

SUMMARY AND CONCLUSIONS.

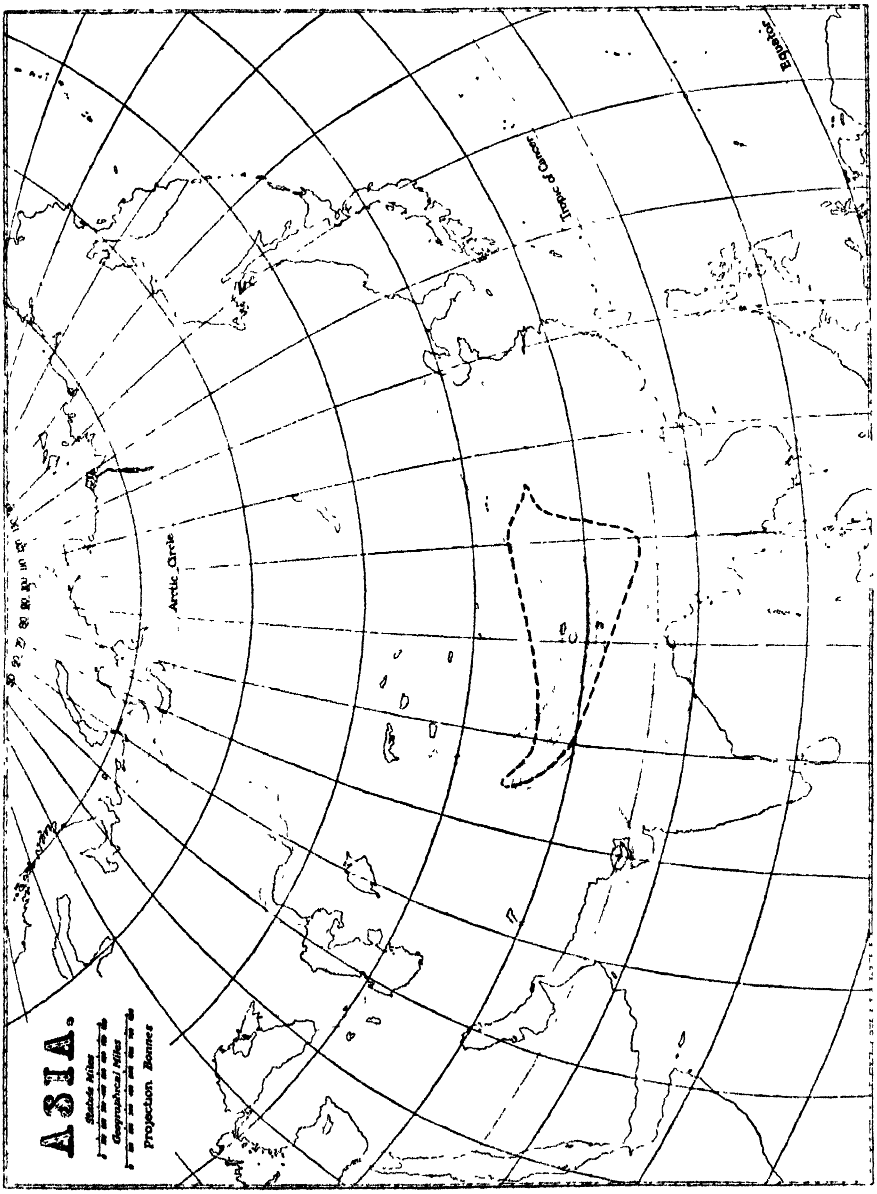
It now remains to weave into some sort of continuous story the facts of structure and geography described above, and to suggest what may have been the history of the genus *Cremanthodium*.

There can be little doubt that *Cremanthodium* and *Ligularia* are very closely related, and that one is immediately derived from the other. Apart from this, *Cremanthodium* shows no great resemblance to any other genus; it is restricted to a much narrower range of habitat and has a much smaller range than *Ligularia*, and so it seems very probable that this latter is the parent genus from which it has evolved. At the same time, there is no evidence that *Cremanthodium* is rigidly monophyletic or that it is derived from a single Ligularioid ancestor. On the contrary, there are in it two very well-marked facies depending chiefly on two quite distinct leaf-forms. Although some intermediates exist, it is possible that these two types represent two different lines of descent from *Ligularia*. It is even possible that certain isolated species may also have been derived direct.

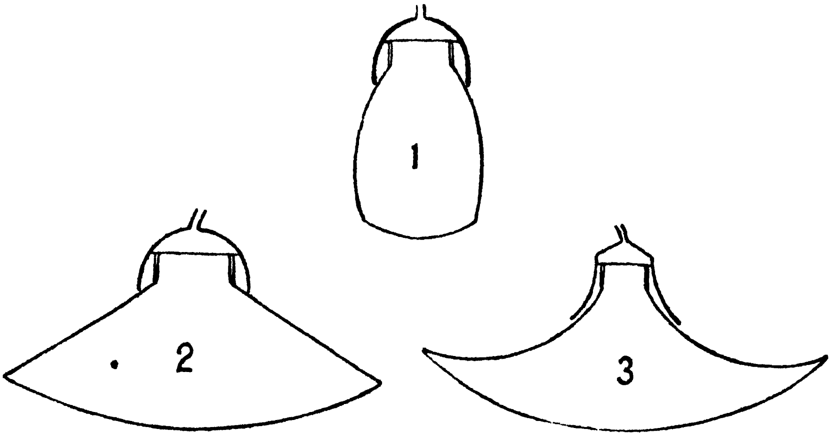
The total area of *Cremanthodium* is well within that of *Ligularia*, and there is no evidence of any general migration of the genus as a whole. There is reason to believe that over much of its range there have been alpine conditions ever since its inception. Its greatest centre of species population is in that part of the Chinese mountains with, at present, the highest elevations and with the longest montane history. Such considerations suggest that the present point of highest species concentration happens also to be the generic point of origin, although there is not necessarily any relation between the two facts.

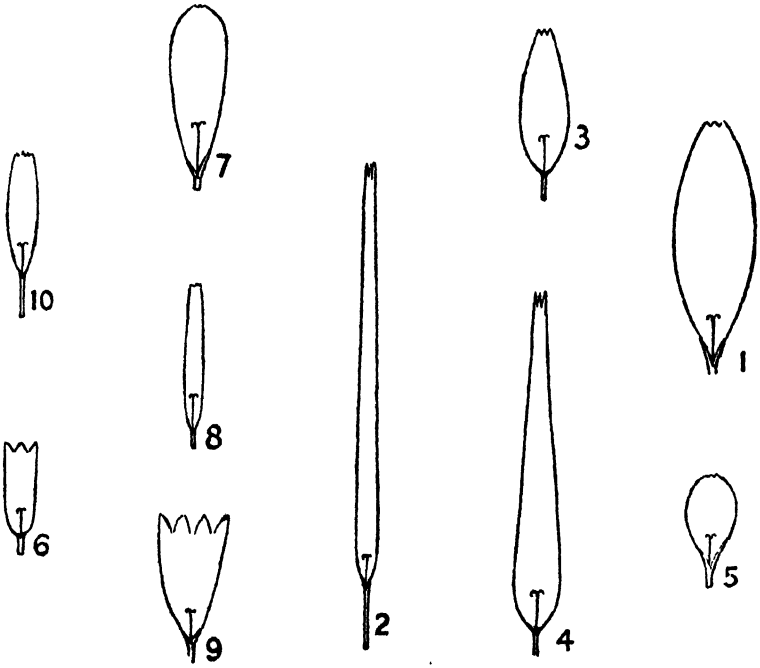
There is not very much evidence to show when the genus arose and whether it antedates the Himalayan uplift or not, but there are several significant points which support the former view. Before the Himalayan uplift it is likely that the distribution of climate in Central Asia was very different, and in particular that the western Chinese mountains were, except in the south-west, much wetter than now. It is also probable from geological considerations that these western mountains afforded the only alpine habitats. Later, when the uplift came, the elevations of the south-western mountains was very much increased. The raising of the Himalayas had a double reaction; it provided an enormous new area of Alpine habitats, and it shut off the moisture-laden winds from the middle and northern parts of the western Chinese mountains. Assuming a pre-Himalayan origin for *Cremanthodium*, we should, from these arguments, expect to find it well distributed over the Chinese mountains, but with its geography perhaps modified in the north by climatic change and with its new species in the southern part, where change of condition has been to its advantage. Similarly, on the Himalayas we should expect to find the genus represented by those wide species which have best and most quickly spread from China, and by a comparatively small number of endemics, this being correlated with the shorter time-period involved. On the other hand, supposing the genus originated after the Himalayas, then we should expect to find it represented much more evenly in the two mountain ranges, to find very few, if any, species in the northern Chinese mountains, and certainly no massing of endemics in one part of the eastern mountains. It might also be reasonably anticipated under such conditions that the genus would show at least a partial origin in the Himalayas themselves.

There is no question as to which of these views the actual facts support, and the geography shows just those features which would be associated with a pre-Himalayan origin in the Chinese mountains. The hypothetical history of *Cremanthodium* may thus be summarized in the following sentences. The genus arose from the pre-existing genus *Ligularia* at some time prior to the Himalayan uplift and in the more southerly part of the western Chinese mountains. During its early period it succeeded in colonizing almost the whole of these mountains up to Kansu. Then came the uplift of the Himalayas, which not only presented a great range of new habitats, but also seriously modified the climate in the north of the Chinese mountains. Since that time the genus has spread rapidly along the Himalayas, but its already existing range in the Chinese mountains has remained the same or perhaps been slightly modified, and a number of new species have arisen in the south-west.



CREMANTHODIUM Benth.





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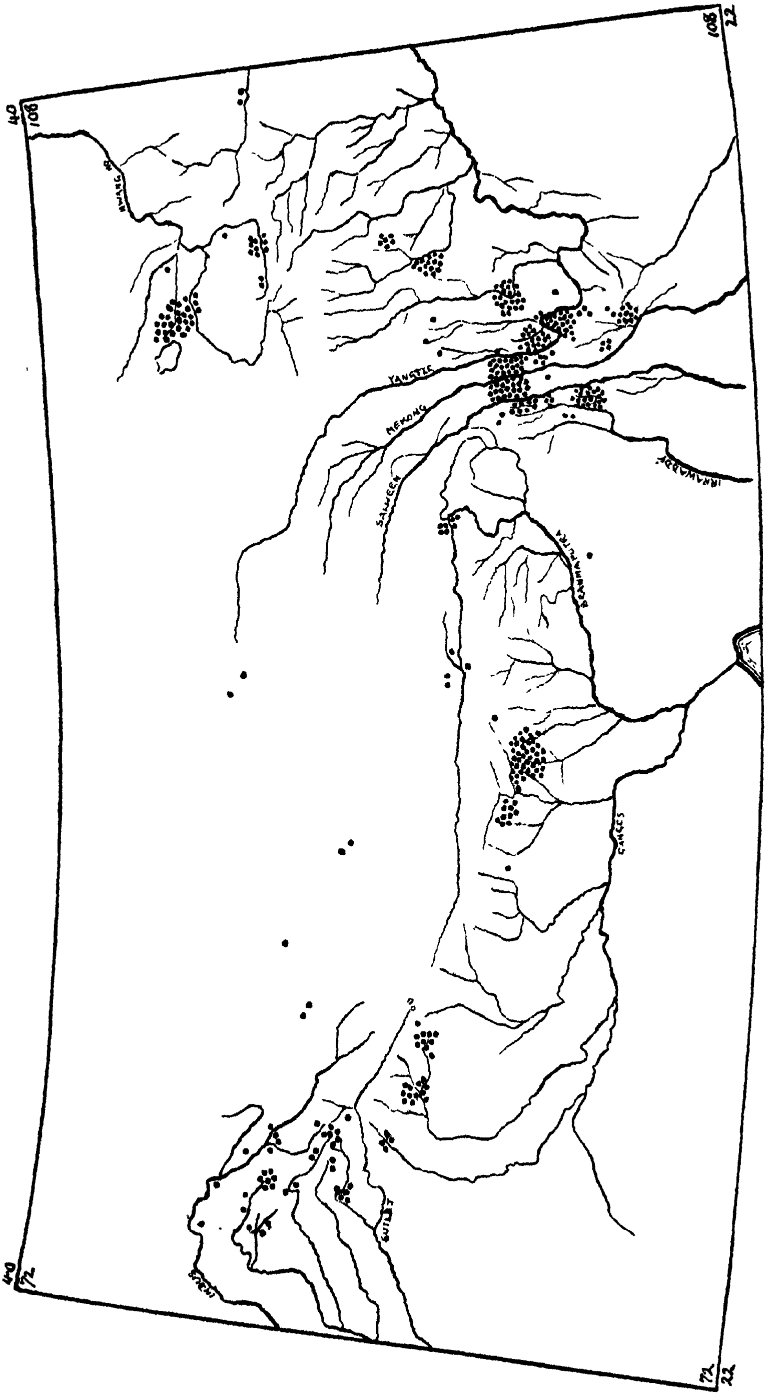

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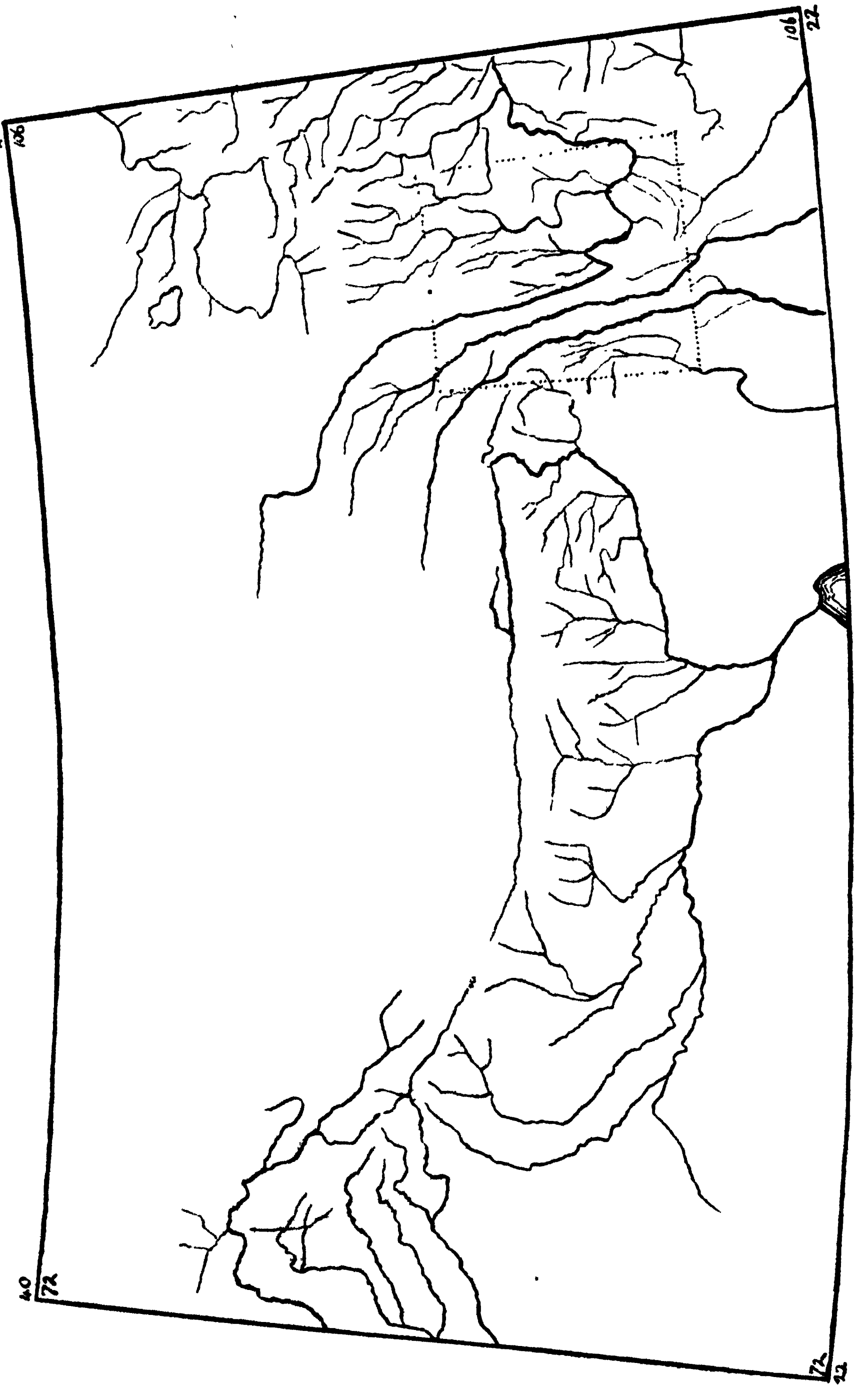
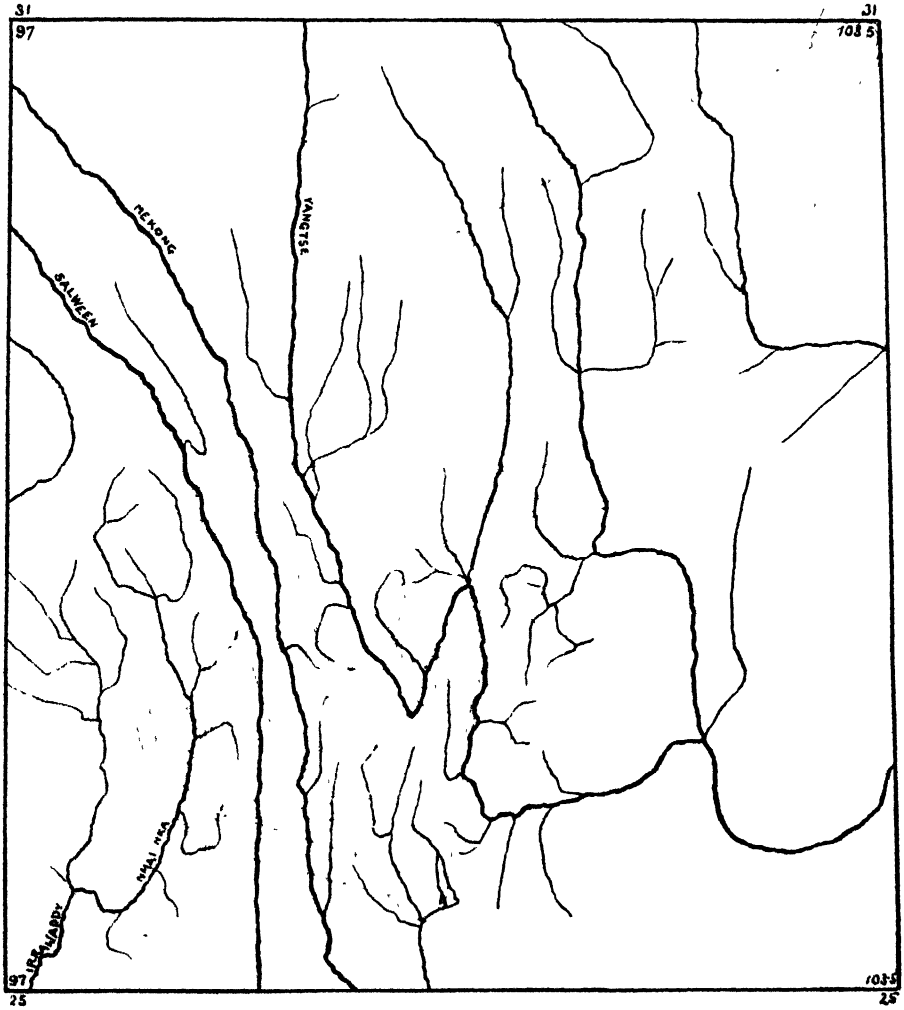


CREMANTHODIUM Benth.



CREMANTHODIUM Benth.

My most grateful thanks are due to Professor W. Wright Smith and Mr. Edgar Evans, not only for the loan of specimens, but also for many kindnesses and help received from them while working at Edinburgh, and to the Directors of the Herbaria at Kew, Paris, Berlin, Vienna, Leningrad and Calcutta for permission to study the collections under their charge and for the loan of specimens.

The above revision was carried out in the British Museum Herbarium while the author was a member of the staff of the Department of Botany.

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EXPLANATION OF THE PLATES.

Plate 9.

Map of the generic area of *Cremanthodium* (outlined in broken black), with approximate lines of total annual rainfall superposed (unbroken red).

Plate 10.

Above:—1. Diagrammatic vertical section of "suburceolate" capitulum. 2. Diagrammatic vertical section of "hemispherical" capitulum. 3. Diagrammatic vertical section of "campanulate" capitulum.

Below:—Ligules of various species: 1. *C. reniforme*; 2. *C. stenactum*; 3. *C. Decaisnei*; 4. *C. citriflorum*; 5. *C. pleurocaule*; 6. *C. pinnatifidum*; 7. *C. palmatum* subsp. *rhodocephalum*; 8. *C. oblongatum*; 9. *C. sino-oblongatum*; 10. *C. rumicifolium*. All approximately natural size.

PLATE 11.

Map showing the total distribution of the genus *Cremanthodium.* (Each black dot denotes a separate collecting.)

PLATE 12.

Map showing the distributions of those species of *Cremanthodium* not confined to the south-west of China. (The portion enclosed with black dotted lines represents the area of the larger scale, Pl. **13.**) 1. *C. palmatum* subsp. *rhodocephalum*; 2. *C. palmatum* subsp. *Benthami*; 3. *C. Thomsoni*; 4. *C. Decaisnei*; 5. *C. Decaisnei* f. *sinense*; 6. *C. reniforme*; 7. *C. retusum*; 8. *C. cremanthodioides*; 9. *C. oblongatum*; 10. *C. arnicoides*; 11. *C. rumicifolium*; 12. *C. lineare*; 13. *C. plantaginifolium*; 14. *C. plantagineum*; 15. *C. pinnatifidum*; 16. *C. discoideum*; 17. *C. pseudo-oblongatum*; 18. *C. humile*; 19. *C. Hookeri*; 20. *C. nanum.*

PLATE 13.

Map showing the distributions of those species of *Cremanthodium* confined to south-western China and adjacent regions:—1. *C. Wardii*; 2. *C. campanulatum*; 3. *C. bulbilliferum*; 4. *C. gracillimum*; 5. *C. pulchrum*; 6. *C. Smithianum*; 7. *C. Farreri*; 8. *C. citriflorum*; 9. *C. phœnicochætum*; 10. *C. calcicolum*; 11. *C. atrocapitatum*; 12. *C. microcephalum*; 13. *C. Principis*; 14. *C. gypsophilum*; 15. *C. cyclaminanthum*; 16. *C. acernuum*; 17. *C. Potanini*; 18. *C. Forrestii*; 19. *C. atroviolaceum*; 20. *C. Delavayi*; 21. *C. sino-oblongatum*; 22. *C. pleurocaule*; 23. *C. nobile*; 24. *C. stenactium*; 25. *C. Helianthus*; 26. *C. suave*; 27. *C. angustifolium*; 28. *C. bupleurifolium*; 22. *C. variifolium*; 30. *C. Prattii*; 31. *C. lineare.*

Studies in the Geotropism of Pteridophyta *.—IV. On Specificity in Graviperception. By T. L. Prankerd, B.Sc., F.L.S., Lecturer in Botany at the University of Reading.

(Plates **14** & **15**.)

[Read 1st November, 1928.]

INTRODUCTION.

In a previous account (Prankerd, 1925) of the graviperception of *Osmunda regalis*, some comparison was drawn between its behaviour to gravity and that of *Asplenium bulbiferum*. Other species of these genera have now been studied in order to ascertain firstly whether they differed from each other in their quantitive reaction to gravity, and secondly if a generic difference of a higher order existed, *i. e.*, if the species of one genus differed among themselves to a less extent than they did from those of the other genus.

The experiments described were all conducted at a temperature of 20° C. ± 1° and a relative humidity of about 80 per cent. Further details of conditions and methods have been given in previous papers of this series.

Presentation time has been used as before to measure the degree of irritability, and is here defined as the minimum period which, under the given conditions, will generally produce a movement of about 5° and only rarely exceeding 10°. In over a thousand experiments on *Asplenium bulbiferum* the presentation time has been calculated on a $\frac{4}{5}$ basis, *i. e.*, that period has been accepted which will cause 80 per cent. of the fronds used to execute a minimum visible curvature. This is the proportion aimed at in the present work, though, owing to the high degree of individual variability, it has not been deemed necessary in all cases to make the large number of experiments actually required to obtain this ratio. Often only a few experiments are needed to confirm a presentation time for a particular stage, which can also be deduced from those already known.

The same abbreviations are here used as formerly to denote the various stages of the developing frond :—

L.I.=Late infant, *i. e.*, leaflets still enclosed in apical coil, with the first pair directed downwards.

$A_{1,2,3}$ etc.=Adolescent 1, 2, 3, etc., *i. e.*, 1st, 2nd, 3rd, etc. pairs of leaflets expanding and flush with the apical coil.

M_0=Sub-mature, *i. e.*, the apical coil is uncurled, but the free tip points inwards or adaxially.

M=Mature, *i. e.*, frond fully expanded.

$M_{1,2}$ etc.=Mature for 1, 2, etc. days.

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* The previous studies of this series are cited at the end of this paper, p. 336.

In addition : P.S. = period of stimulation.
P.T. = presentation time,
and L.T. = latent time, *i.e.*, "the period elapsing between the beginning of stimulation and the first indication of response."

The relative sensitivity of the frond at different stages to the force of gravity can be most clearly expressed by a curve where the ordinates are the presentation times and the abscissæ the periods intervening between the stages. This curve is not truly mathematical, but what may be called a physiological graph, which I propose to term a *graviscript*. The complete graviscript for *Asplenium bulbiferum* has already been constructed under my direction by my student, Miss Waight (1923). In this work, only the stages above enumerated have been used, since experiments on earlier stages are lengthy and troublesome, and would add little to the facts and nothing to the conclusions drawn.

The Reaction to Gravity of Asplenium trichomanes.

Over 300 experiments have been carried out on *Asplenium trichomanes* in order to compare its reaction to gravity with that of *A. bulbiferum*. They had to be made under the same conditions, and hence at a temperature of 20° C. Since this is probably somewhat high for this species, the plants used were grown in an outdoor frame and brought into the research greenhouse only for a few days at a time. Measurements of growth were always taken of fronds used for experimentation, and showed an average of ·2–·3 cm. per day for stages $L.I._3$–A_2, and of about ·4 cm. for stages above this. As with other ferns, experiments were generally rejected where growth was very slight or nil, and when growth steadily declined the plants were replaced in the frame. Some representative experiments will now be given for the stages L.I.–A_{13}. The figure after the stage gives the average length of the frond in centimetres. These quantities, together with the P.T. and L.T. in this and other tables, are usually based on a far larger number of experiments than those cited.

TABLE I.

Length of Frond in cm.	P.S. in hours.	Angle of Curvature in degrees.	L.T. in hours.
Stage: L.I. = 1·25 cm.			
·5	2·0	5	4·5
1·2	2·0	5	5·0
1·6	2·0	5	5·5
·5	2·0	5	6·0
1·9	2·0	—	—
1·5	1·5	—	—
1·2	1·0	—	—

P.T. = 2 hours; L.T. = 5·4 hours.

TABLE I (*cont.*).

Length of Frond in cm.	P.S. in hours.	Angle of Curvature in degrees.	L.T. in hours.
Stage A_1=1·4 cm.			
1·5	1·5	10	5·5
2·0	1·5	5	5·5
1·2	1·5	3	5·0
1·5	1·5	—	—
1·2	1·0	—	—
		P.T.=1·5 hours; L.T.=5·3 hours.	
Stage A_2=1·9 cm.			
2·0	1·0	10	3·5
1·9	1·0	5	5·5
1·6	1·0	5	6·0
2·3	1·0	3	5·0
2·0	1·0	—	—
2·0	75	—	—
		P.T.=1 hour; L.T.=5·0 hours.	
Stage A_{3-13}. (Number of pairs of leaflets unfolded placed in brackets after length in this table.)			
3·1 (6)	1·0	15	4·0
6·5 (9)	1·0	12	3·0
2·6 (5)	1·0	5	3·0
2·1 (3)	1·0	5	3·5
6·9 (10)	1·0	5	5·0
6·2 (13)	1·0	5	5·5
5·3 (8)	1·0	3	4·0
4·7 (7)	1·0	3	4·0
5·3 (7)	1·0	—	—
3·3 (3)	1·0	—	—
		P.T.=1 hour; L.T.=4·5 hours.	

The values assigned to the P.T. and L.T. for the first three stages are based on figures giving approximately the 4 : 1 ratio (*i. e.*, for the responding to the non-responding). Fronds of this fern often possess as many as thirty or more pairs of leaflets, and sufficient experiments were not made to deduce the exact P.T. for each stage. A P.S. of one hour was used in a number of cases ranging from A_{3-13} which yielded a response of 70 per cent. in stages A_{3-6}, 60 per cent. in stages A_{7-10}, while only 40 per cent. response was recorded in stages above this, though a longer stimulus was sometimes given. The results indicate, therefore, that sensitivity is greatest at A_2 and gradually declines as the frond develops.

Comparison of the Two Species of Asplenium *.

Comparing the two species, we see that in the important stages L.I. and A_1, the latter of which marks the transition from the infant to the adolescent phase, the P.T. is actually, and the L.T. almost, identical. The L.T. is also at its minimum at stages A_{5-6}, and rises for both at A_{6-7}. Nevertheless, a clear difference is shown in the much greater irritability of *A. bulbiferum* and the quicker response, on the other hand, of *A. trichomanes.* It might be suggested that the latter is correlated mechanically with the relative slenderness of the frond. But ferns are known to me possessing much thicker fronds than *A. trichomanes* which execute geotropic movements more quickly still ; so that this is not a probable explanation.

The Reaction to Gravity of Osmunda gracilis.

The species of *Osmunda* most fully studied for comparison with *O. regalis,* the figures for which have already been published (Prankerd, 1925), were healthy, fruiting specimens showing an average growth of something under a centimetre a day. Table II gives a few experiments typical of about 500 performed over a period of five years on fronds ranging from the infant to the mature phase.

TABLE II.

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours.
Stage L.I. = 7·6 cm.			
8·7	12	5	1·5
6·3	12	5	2·5
7·2	12	3	1·5
7·5	12	3	3·0
7·3	12	—	—
9·9	10	—	—
8·5	10	—	—
	P.T. = 12 minutes ; L.T. = 2·1 hours.		
Stage A_1 = 8·8 cm.			
11·9	9	5	1·0
9·5	8	5	1·5
6·1	8	5	2·0
11·0	8	3	1·25
10·7	8	3	2·0
6·9	8	—	—
	P.T. = 8 minutes ; L.T. = 1·7 hours.		

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* For the details of *A. bulbiferum,* see Waight, 1923.

TABLE II (*cont.*).

Length of Frond in cm.	P.S. in hours.	Angle of Curvature in degrees.	L.T. in hours.
Stage A_2=13·9 cm.			
12·8	7	10	1·0
17·5	7	5	2·0
9·6	7	5	1·25
18·9	7	4	2·0
10·3	7	—	—
11·3	6	—	—
		P.T.=7 minutes;	L.T.=1·6 hours.
Stage A_3=19·4 cm.			
21·9	5	10	1·5
24·0	5	5	1·0
19·4	5	5	1·5
15·0	5	5	2·0
12·0	5	3	1·25
21·8	5	—	—
25·0	4	5	1·25
23·2	4	—	—
16·1	4	—	—
		P.T.=5 minutes;	L.T.=1·5 hours.
Stage A_4=22·5 cm.			
26·8	4	10	1·0
22·0	4	5	1·5
19·0	4	5	1·5
15·2	4	3	1·0
16·5	4	3	2·0
24·5	4	—	—
23·5	3	—	—
17·2	3	—	—
		P.T.=4 minutes;	L.T.=1·4 hours.
Stages A_{5-6}=29·3 cm. (Number of pairs of leaflets unfolded placed in brackets after length in this table.)			
38·0 (6)	10	10	1·5
25·8 (5)	10	5	1·5
30·3 (5)	8	15	1·0 *
36·0 (5)	8	5	1·5
25·9 (6)	8	5	1·5
34·4 (5)	8	—	—
30·2 (5)	8	—	—
27·0 (5)	8	—	—
		P.T.=8 minutes;	L.T.=1·5 hours.

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* A fruiting frond. There is some evidence to show that fertile fronds are more irritable than sterile ones, but sufficient figures are not yet available.

TABLE II (*cont.*).

Length of Frond in cm.	P.S. in hours.	Angle of Curvature in degrees.	L.T. in hours.
Stages M_0 and M=26·9 cm.	(Stages indicated after length.)		
42·7 (M)	20	20	·75
32·0 (M)	15	10	2·0
33·7 (M)	15	5	1·5
29·0 (M_0)	15	3	2·0
33·7 (M)	15	—	—
16·9 (M_0)	15	-	—
17·0 (M_0)	12	25	3·5
26·8 (M)	12	20	1·0
33·2 (M)	12	5	1·5
30·2 (M)	12	5	2·0
40·2 (M_0)	10	—	—
32·2 (M)	10	—	—

P.T.=12 minutes (?); L.T.=1·8 hours.

O. gracilis is a more delicate plant than those previously described, and its growth easily declines or stops altogether. When quite healthy, however, it is a satisfactory fern to use for this work, showing on the whole less variability than many, and yielding very sharply-defined results for some stages. For example, in fifteen critical experiments on A_3 with a P.S. of 5 minutes, twelve responded, two with a somewhat higher angle than 5°; while out of nine experiments with a P.S. of 4 minutes, only one frond moved. This fixes the P.T. very precisely at 5 minutes for this sagte. In later adolescent stages of ferns, as previously shown for *Asplenium bulbiferum* (Waight, 1923), the degree of gravitational irritability is often more influenced by the nearness to maturity than by the distance from infancy; and this period is indicated by the number of leaflets still in the apical coil, and not by the number already unfolded. At A_{5-6} the fronds of the plants under consideration were closely approaching maturity, but would not be so advanced in larger plants, and hence might show a lower P.T. than that recorded above. It seems certain, however, that the fronds are less sensitive at the mature and sub-mature stages than at the adolescent, and this affords a contrast with *O. regalis*. For though the plants used were somewhat smaller and may have been younger than those employed in the work on *O. regalis*, they were fruiting and apparently adult. And even in two-year-old sporelings of *O. regalis*, which never fruited (Prankerd, 1925) and were far smaller than the experimental plants of *O. gracilis*, the most sensitive period coincided with maturity (Prankerd, 1925, p. 715). So that a possibly younger condition of the plants can scarcely account for the lower sensitivity—which may be roughly reckoned as about one quarter that of the royal fern. Still less would it invalidate the contrast afforded by the occurrence of the point of greatest sensitivity at different stages in the two species, which is apparently a constant specific difference in physiological behaviour.

The Reaction to Gravity of Osmunda cinnamomea *L.*

Osmunda cinnamomea is a North American species which, owing to a peculiar anatomical feature, has figured largely in discussions on the phylogeny of the Osmundaceæ (Scott, 1920). After much searching, two plants were at last obtained which grew well and reached the height of over a metre, fruiting freely. In habit the plant differs from *O. regalis*, and even more strongly from *O. gracilis*. The fronds arise almost simultaneously in the spring, and growth is completed in May, normally with a crown of fertile leaves, recalling *Cycas revoluta*. The plants die down completely in the winter, and ours were placed in the ground in the open. In the spring each somewhat disk-shaped rootstock threw up several groups of fronds, but they never reached the former height and no fertile fronds were developed. The gravitational phenomena, however, did not seem to differ in the two years, except possibly in the later stages. Here, curiously enough, the shorter fronds of the second year were apparently the more sensitive, though true gravitational curvatures of a slight character are very difficult to recognize with certainty in the better-developed fronds, owing to the swaying movements consequent on their great height. About a hundred experiments were carried out on fronds of all stages ranging from 6 to 100 cm., of which the following are typical :—

TABLE III.

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours
Stage L.I.=14·4 cm.			
6·1	6	10	1·5
25·9	6	5	1·0
18·1	4	—	—
6·4	4	—	—
	P.T.=6 minutes (?); L.T.=1·3 hours.		
Stage A_1=18·1 cm.			
8·0	6	8	1·5
30·0	5	10	1·25
8·4	4	5	1·0
10·0	4	5	1·5
8·9	4	3	2·0
8·2	4	3	2·5
8·6	3	3	2·0
14·5	3	—	—

TABLE III (*cont.*).

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours.
31·0	2	3	1·5
25·0	2	—	—
6·5	2	—	—
		P.T. = 4 minutes ;	L.T. = 1·5 hours.
Stage A_2 = 20·2 cm.			
18·0	5	3	1·75
8·7	4	7	1·5
22·2	3	5	1·5
38·3	2	—	—
14·0	1	—	—
		P.T. = 3 minutes ;	L.T. = 1·3 hours.
Stage A_3 = 19·9 cm.			
10·2	5	8	1·25
23·0	4	5	1·0
11·3	1	15	1·0
35·2	1	3	2·0
		P.T. = 1 minute ;	L.T. = 1·3 hours.
Stages A_{4-14}. (Number of pairs of leaflets unfolded placed in brackets after length in this table.)			
15·2 (5)	½	15	1·0
18·7 (5)	½	15	1·0
12·1 (4)	½	10	1·5
20·0 (9)	⅓	10	1·5
28·0 (14)	½	10	2·5
20·7 (9)	½	7	1·5
16·7 (6–7)	½	5	1·5
12·0 (4)	½	—	—
17·7 (7)	⅓	10	1·5
22·0 (10)	⅓	5	1·5
25·6 (12)	⅓	—	—
17·4 (7)	⅓	—	—
		P.T. = 30 seconds ;	L.T. = 1·5 hours.
Stages M_0 and M. (Stages indicated after length.)			
100·0 (M)	4	—	—
97·7 (M_0)	4	—	—
28·5 (M)	2	10	2·5
22·5 (M_0)	2	—	—
82·4 (M)	1	20	1·25
84·0 (M)	2	10	1·0
84·5 (M)	1	—	—
26·5 (M_0)	1	—	—
83·2 (M)	¼	—	—
			L.T. = 1·6 hours.

In the above table the relative constancy of physiological behaviour in fronds differing so greatly in height is worthy of remark. The phenomenon of "exuberance" or unusual sensitivity of the first fronds to appear, noted for *O. regalis* (Prankerd, 1925, p. 712), is shown in a marked degree by this plant. Sometimes the earliest fronds were actually more irritable in their infant than adolescent phases, which is unique in my experience.

With regard to the deduced P.T., it is quite possible that it might prove to be slightly lower than that given—perhaps a minute less in the first two stages, and A_3 might be found to respond to half a minute's stimulation. But this would only accentuate the fact that this species has now been shown to rival *O. regalis* "as the most sensitive plant to the force of gravity yet discovered" (Prankerd, 1925, p. 719). At each stage up to late adolescence the P.T. is less than that for the corresponding one in *O. regalis*, and a definite response to gravity has been obtained—it is believed for the first time—to a stimulus as short as 20 seconds. As in *O. regalis* and *O. gracilis*, a tendency to the "all-or-none" law (*cf.* Prankerd, 1925, p. 317) is evident in the later stages, and especially at maturity. Relatively large movements are made or none at all, and response seems almost independent of the length of the stimulus—*e.g.*, 1 minute may give a movement of 20° (see above), while 4 minutes elicits no response. A true P.T. can therefore scarcely be held to exist.

It may be recalled that morphologically *O. cinnamomea* differs very strikingly from *O. regalis*, and indeed from all other species of the genus, in the form of the leaf, which, superficially at least, is much more like an *Aspidium*. Biologically it approaches *O. regalis* more nearly than the other species dealt with here in its complete inactivity during the winter, while in graviperception it is more closely allied to this species than to the others investigated. This is shown by its high degree of sensitivity maintained throughout adolescence to maturity, though it is specifically distinct, as already pointed out. The growth-rate is very high in this fern, sometimes reaching as much as 2 mm. per hour, so that young fronds may almost be seen to grow.

The Reaction to Gravity of Osmunda regalis *var.* japonica *C. Chr.**

Over 100 experiments have been made on all stages of *Osmunda japonica*, of which Table IV is representative. The plants used were very kindly sent me by Prof. W. H. Lang, F.R.S. They were at first only a few centimetres high, but after cultivation for several years many fronds reached a length of 20 cm., though very few were fertile. Hence the lowest P.T. recorded in this paper, 10 minutes, may not represent the maximum sensitivity that larger plants might attain, and further experimentation when the plants are older is contemplated.

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* Hereinafter referred to as *Osmunda japonica*.

TABLE IV.

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours.
Stage L.I.=4·4 cm.			
5·4	15	15	2·0
5·3	15	7	1·5
5·5	15	3	2·5
2·5	15	—	—
		P.T.=15 minutes;	L.T.=1·9 hours.
Stage A_1=6·3 cm.			
3·5	12	7	2·5
7·2	12	5	1·0
8·0	12	3	1·5
5·2	12	3	2·5
		P.T.=12 minutes;	L.T.=1·9 hours.
Stage A_2=9·6 cm.			
15·8	12	20	1·5
13·1	12	12	2·0
7·5	10	12	1·5
11·1	10	5	1·5
9·5	10	5	2·5
6·5	10	5	2·5
9·1	10	3	2·5
8·0	10	—	—
8·5	8	5	1·5
14·2	8	—	—
10·8	8	—	—
		P.T.=10 minutes;	L.T.=1·8 hours.
Stage A_3=11·7 cm.			
8·4	12	7	2·0
19·5	10	20	2·0
14·7	10	5	1·75
9·8	10	5	3·0
18·2	10	3	1·5
9·8	8	—	—
19·5	5	—	—
		P.T.=10 minutes;	L.T.=2·0 hours.
Stage A_4=16·9 cm.			
17·0	12	12	1·0
15·9	10	5	1·3
17·7	10	3	1·5
15·5	10	—	—
19·1	8	3	1·5
20·5	8	—	—
16·0	5	—	—
		P.T.=10 minutes;	L.T.=1·4 hours.

TABLE IV (*cont.*).

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours.
Stages M_0, M, M_1, and M_2.	(Stages indicated after length.)		
13·3 (M)	20	20	1·5
7·2 (M_0)	15	5	1·5
8·5 (M)	15	—	—
15·7 (M)	12	25	1·25
19·3 (M)	12	20	1·0
13·4 (M_1)	12	5	1·5
14·1 (M_2)	12	5	1·5
10·3 (M_0)	12	5	2·5
24·6 (M_0)	12	4	2·0
12·9 (M_0)	12	3	2·0
17·8 (M_0)	12	—	—
11·0 (M_0)	12	—	—
11·0 (M_0)	10	5	1·5
15·7 (M)	10	5	3·0
13·6 (M)	10	—	—
10·5 (M)	10	—	—
11·5 (M_0)	8	—	—

P.T. = 12 minutes (?); L.T. = 1·9 hours.

Only a few fronds unfolded as many as five pairs of leaflets while still in the adolescent phase, and experiments on them indicated that 8 minutes would probably represent the P.T. Yet it was shown above that the large fruiting plants of *O. cinnamomea* did not differ essentially from the smaller, sterile specimens, and inspection of the figures shows that the length of the frond does not greatly influence the intensity of graviperception. True, the age of the plant is an important factor (Prankerd, 1925), but here the plants used were known to be at least four years old. Hence the figures may be taken as fairly representing *O. japonica*, and once again they show a generic likeness with specific difference. The average growth per day is 1·4 cm., *i.e.*, nearly double that of *O. gracilis*; yet it is less sensitive throughout adolescence, though at the mature phase about the same.

The Reaction to Gravity of Osmunda regalis *var.* undulata *Hort.**

Some of the specimens of *O. undulata* were also obtained through the kindness of Prof. Lang, and have a similar history. This material was supplemented by a few larger plants which came from Perry's Plant Farm at Enfield. The fronds have reached a height of 20 cm. and show an average growth of 1·2 cm. a day, but they have very rarely fruited. Table V gives the details of some 40 experiments out of about 150 carried out on these plants.

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* Hereinafter referred to as *Osmunda undulata*.

TABLE V.

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours.
Stage L.I. = 2·9 cm.			
2·7	6	10	2
2·4	6	5	2
2·15	6	5	2
3·1	6	3	3
1·9	6	—	—
2·2	5	—	—
		P.T. = 6 minutes ; L.T. = 2·2 hours.	
Stage A_1 = 4·6 cm.			
4·3	5	10	4
3·9	5	6	1·3
3·6	5	5	1·25
5·0	5	5	1·5
5·4	5	3	2·0
4·2	5	—	—
3·6	4	3	1·5
2·4	4	—	—
3·5	3	—	—
		P.T. = 5 minutes ; L.T. = 1·8 hours.	
Stage A_2 = 7·7 cm.			
7·0	4	5	1.5
8·0	3	10	1·8
5·9	3	5	1·5
4·7	3	5	2·0
5·2	3	3	2·5
9·3	3	—	—
14·0	2	10	1·5
16·0	2	—	—
11·6	2	—	—
		P.T. = 3 minutes ; L.T. = 1·75 hours.	
Stage A_3 = 9·3 cm.			
8·8	2	10	2·0
12·6	2	5	1·5
13·5	2	—	—
6·9	2	—	—
7·1	1	10	1·0
8·5	1	5	1·75
7·2	1	—	—
			L.T. = 1·7 hours.

TABLE V (*cont.*).

Length of Frond in cm.	P.S. in minutes.	Angle of Curvature in degrees.	L.T. in hours.
Stage $M_0=6{\cdot}7$ cm.			
5·9	10	—	—
5·6	7	—	—
9·2	6	30	1·25
15·0	6	5	1·0
5·2	6	—	—
3·5	5	10	4·0
8·1	5	—	—
4·6	5	—	—
5·8	3	7	1·5
5·3	3	—	—
5·5	½	5	1·5

L.T.=2·0 hours.

In general the same remarks apply to *O. undulata* as were made for *O. japonica*, since the plants employed cannot be considered adult. Yet the variety corresponds almost exactly with *O. cinnamomea* in its early stages, and is more sensitive in its sub-mature phase. No later stages of adolescence than that of A_3 were developed; and the latter, together with M_0, show very markedly the high variability characteristic of the dying-out of gravitational irritability. As the figures indicate, it is impossible to compute a P.T. for these stages, though in older plants such may well exist for A_3, and later adolescent stages developed considerably before the apical coil is entirely unfolded (*cf.* Waight, p. 59). The figures also show, as in other cases, that the L.T. is not thus affected.

Comparison of the Five Species of Osmunda *.

Reviewing the five species of *Osmunda* studied, we cannot fail to be struck by the similarity of the graviscripts for latent time, which closely approximates to 1·6 hours. In the P.T. the graviscripts also show points of resemblance, with sharply-defined differences in at least four species. Those of *O. japonica* and *O. undulata* are possibly not strictly comparable with the others, since the plants were not probably as old. They have been included because, for reasons given above, the presentation times are not likely to differ greatly in older plants for the stages given, and the latent times are almost certainly correct.

While the distinctions between *O. regalis*, *O. gracilis*, and *O. cinnamomea* are obvious at a glance, *O. japonica* and *O. undulata* closely resemble *O. regalis*; nevertheless, it was found possible to identify a plant of one of the latter varieties which had lost its label by its reaction to gravity. Again, plants sent to me labelled "*Osmunda palustris*," but having the appearance of *O. gracilis*, gave presentation times so indistinguishable from those of the latter that they were considered identical, which proved to be the case. Of course, other and quicker methods of identification would usually be available, but it seemed of interest to record that these forms were actually determined by a physiological criterion.

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* For the details of *O. regalis*, see Prankerd, 1925.

It may also be noted that *O. cinnamomea*, an aberrant species both morphologically and anatomically, is quite true to type in this aspect of physiological behaviour.

DISCUSSION OF RESULTS.

A comparative review of the results of this work is shown by the graviscripts for both P.T. and L.T. of the seven species of Filicales given on Pls. **14–15** and Table VI summarises what has been deemed the most important data in connection with their reaction to gravity. Columns 3, 4, and 5 give some idea of the morphological development of the fronds at the stage of minimum P.T., which latter, with the corresponding L.T., is shown in columns 1 and 2. (It will be noted that the minima of the last two quantities very nearly coincide.) The P.T. and L.T. at A_1 are added, since they are instructive as showing the specific differences at a stage which would usually prove a suitable one to take as typical for a given fern. It is very precisely defined and easily seen*, less variable than many, and just halfway between the infant and adolescent phases. In the two species of *Asplenium*, however, the P.T. for A_1 is identical, and hence expresses generic likeness rather than specific difference. Some of the contrasts drawn between *A. bulbiferum* and *O. regalis* in a previous study (Prankerd, 1925) receive support from the present work, and are shown to be generic. These are :—

1. The much higher ratio of the presentation times at early and late stages in *Asplenium* than in *Osmunda*.

2. The far greater sensitiveness of *Osmunda* (at least three times, and reaching sixty and even ninety times that of *Asplenium*). The P.T. is measured in minutes for *Osmunda*, in hours for *Asplenium*.

3. The L.T. for *Osmunda* shows an approximately constant value of 1·6 hours, while that of *Asplenium* is about three times as great (with extremes of 4·6 hours).

Roughly, therefore, *Osmunda* is far more sensitive over a longer period of development than is *Asplenium*, and responds three times as quickly.

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* Different stages of the infant phase are not always easy to see in very small or woolly fronds, and adolescent stages are sometimes ill defined, owing to the variable morphology of the frond, *i.e.*, the disposition of the leaflets, the method of uncurling, etc.

TABLE VI.

	Minimum P.T.	Minimum L T	Stage.	Average Length in cm.	Growth per day in cm.	P.T. at A_1.	L.T. at A_1.
Asplenium bulbiferum........	·5 hours.	5·0 hours.	A_{5-7}	17·0	1·0	1·5 hours.	5·5 hours.
Asplenium trichomanes	1·0 "	3·9 "	A_{2-6}	3·0	·35	1·5 "	5·0 "
Osmunda regalis	1 or ½ minutes.	1·25 "	M_0	38·0	2·4	6 minutes.	1·5 "
Osmunda gracilis	4 minutes.	1·5 "	A_4	22·5	·7	8 "	1·7 "
Osmunda cinnamomea	½–⅓ minutes.	1·5 "	A_{4-14}	20·0	3·0	4 "	1·5 "
Osmunda japonica	10 minutes.	1·6 "	A_{2-4}	13·0	1·3	12 "	1·9 "
Osmunda undulata	3 (1 ?) minutes.	1·7 "	A_{2-3}	8·5	1·2	5 "	1·8 "

Specific differences are shown far more clearly in the P.T. than in the L.T. The latter is clearly much greater for *A. bulbiferum* than for *A. Trichomanes*, but is not usually specifically distinct in *Osmunda*, though *O. regalis* seems unique in responding most quickly at maturity. Turning to the P.T., the two species of *Asplenium* differ from each other markedly after the A_2 stage, *A. Trichomanes* never reaching as high a degree of irritability as *A. bulbiferum*. In the genus *Osmunda*, *O. regalis* is again unique in attaining its highest sensitivity at maturity. A glance at the graviscripts (Pl. **14**) shows that four out of the five species can be arranged in a series according to their relative sensitivity, the relation holding in each stage except that just cited for *O. regalis*. These are from highest to lowest: *O. cinnamomea*, *O. regalis*, *O. gracilis*, *O. japonica*. At A_1 and A_2 the first species is approximately three times, the second species twice, and the third species half as sensitive again as *O. japonica*. For no reason at present apparent *O. undulata* seems to coincide with *O. cinnamomea*, though further work in older plants may yet show some constant specific difference. Thus, although every fact does not "fit in," and some modifications may subsequently be made, the evidence is clear that six at least of the seven species examined differ among themselves in their reaction to gravity, and that on this basis alone they naturally fall into two groups. In other words, generic and specific physiological characters undoubtedly exist; but much further work will be needed to determine how widespread and constant this phenomenon is. Since, however, it is believed that these are the first studies on the geotropism of Pteridophyta, a few generalisations may very tentatively be put forward. Judging from the species investigated *, the graviperception of a fern frond may be represented by a curve ascending during the infant and early adolescent phases till it reaches a maximum, which will probably be characteristic for the species in quantity, duration, and point of occurrence. This maximum will generally continue to hold good for some time, *i. e.*, there is a flat period during which the power of perception remains constant, after which it declines, vanishing altogether before or soon after maturity. Later stages are more variable than early ones, and when graviperception is disappearing there is a kind of flicker in its intensity like that of a candle flame as it goes out. *O. japonica* and *O. gracilis* retain some degree of sensitivity several days after maturity, but *O. regalis* is the only case at present known where it is at its maximum as the tip of the frond emerges from the coil.

With regard to the factors influencing graviperception and reaction, the external conditions, as already stated, have been kept as constant as possible, and their effect is therefore not yet known. Among internal factors, both the age of the plant and the stage of the frond have been shown to be of great importance (Prankerd, 1925), while the length of the latter matters very little. The figures in the tables for *O. cinnamomea* strikingly illustrate the last point. The growth-rate undoubtedly influences response, as this will scarcely take place at all if growth ceases, and the average growth increment is always higher in responding than in non-responding fronds, other conditions being equal. The L.T. is a relatively constant quantity, *i.e.*, it is less easily influenced than the P.T., which is shown graphically by the flatness of the curves for L.T. The data available are now perhaps sufficient to warrant the following generalisation:—*The latent time for a given species of the Filicales under constant conditions is not greatly affected by the age of the plant, and far less than the presentation time by the degree of development of the frond, for the adolescent stages of which it is at its minimum and approximately constant.* The last two points, *i.e.*, the influence of the growth-rate and the relative constancy of the L.T., are probably not restricted to Pteridophyta, but are widespread phenomena of geotropic irritability.

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* These include some others besides those recorded here, the facts for which have not yet been fully worked out.

In conclusion, attention may be drawn to the ever-widening basis of classification. In the old artificial systems relatively few easily discernible characters, chiefly floral, were employed; while in the early days of the Natural System, though these were greatly extended, reliance was placed almost entirely on morphological characters. Gradually other taxonomic criteria were used or suggested. As far back as 1863 Duval-Jouve (1864) showed that the species of *Equisetum* were anatomically distinct, though forty years later Fritsch (1903) was pleading for a more extensive use of anatomical characters. Solereder's well-known work (1908) shows how largely structural features can be employed in classification, while it is often the sole available method with fragmentary remains of fossil plants. Even embryology can be of taxonomic value, as Schürhof (1924) has recently shown. At the end of last century McFarlane (1899) pointed out that the ultimate factor in the conception of a species was the cell, and that by neglecting its study we should never arrive at the perfect Natural System. A similar point of view was taken by Robertson (1905), who drew attention to the connection existing between cytology and classification. She showed how cytological characters, which are perforce employed almost exclusively to delimit species in unicellular organisms, were often useful in dealing with higher plants. In the study of the cell the distinction between morphology and physiology wears thin, and it is not surprising that so-called physiological characters, *e.g.*, colour, anabolic products, etc., should long have been used in the classification of the lower, and particularly in unicellular plants. For some bacteria, only physiological characters are available, while their importance in delimiting algæ has been emphasized by Fritsch in his recent (1927) address to the Botanical Section of the British Association. He states: "It is well to realize that the characteristics separating the Green and Yellow-green Algæ, like those distinguishing the other great classes of pigmented Protophyta, are essentially physiological. . . . That these diverse classes are also in general characterized by other features, . . . indicates that the physiological distinctions are fundamental." But the use of a purely chemical basis of classification has not been restricted to the lower plants. Onslow (1920) has employed it for Angiosperms, and a physico-chemical basis, *i. e.*, hydrion concentration, has been suggested by Rea and Small (1926). Baker and Smith (1910) have employed cyto-physiological characters in their classification of Gymnosperms, and Reichert's detailed work (1919) on starch has shown that this typical anabolite of the green plant has specific value.

Notwithstanding the new factors taken into account, all the above methods of classification, both of higher and lower plants, are merely qualitative—a fact insisted on by McLeod (1927), who has attempted to give numerical value to morphological characters. All attempts to express degree of relationship quantitatively are to be welcomed as tending to raise the descriptive study of plants to the rank and dignity of an exact science. But it is doubtful how far morphological concepts will lend themselves to such treatment. The recent advances in carefully controlled quantitative methods has enabled physiology to put in a claim to afford specific differences as sharply definable as those of morphology, if far more recondite. An illustrative case in the physiology of nutrition is shown by Dastur's work on the relation between water-content and photosynthesis (1925, fig. 5). We may certainly agree with McLean (1923) that "species is historically a morphological idea," without allowing that it is to remain so exclusively. Thus, Robertson (1905) asserts that were our technique sufficiently refined, "cytology would become the basis of classification"; and McLeod (1927) affirms that "the notion of species is a chemical notion." The present work claims that species may be distinguished by their reaction to stimuli, *i. e.*, that the physiology of irritability can also afford criteria of systematic importance.

It may well be that the use of new characters will in general only justify the acumen of the older taxonomists, and no one acquainted with the extreme laboriousness of quantitative physiological work would suggest its employment for diagnostic purposes if it could possibly be avoided. Nevertheless, in theory at least, *all* data are relevant in a truly Natural System; and if in actual practice a few characters of external morphology are often sufficient to determine a classificatory unit (*e.g.*, the arrangement of the stamens in the Cruciferæ), one need only mention such instances as the genus *Adoxa* (Sprague, 1927) to show how the sole use of these may fail to give anything approaching certainty. And where the systematic position is problematic, the thorough systematist of the future may well have recourse for fresh data to the remote, though it may be decisive, realm of physiology.

SUMMARY.

1. The work is based on some 2300 experiments on seven species of the genera *Asplenium* and *Osmunda*, and gives the quantitative reaction to gravity of the fronds at stages previously defined as infant, adolescent, and mature (Waight, 1923).

2. Specific differences in the presentation time are distinct in all but one case, though slight compared with the generic differences, which are measured in hours for *Asplenium* and minutes for *Osmunda.*

3. *O. cinnamomea* is believed to be the most sensitive plant to the force of gravity as yet discovered, since its fronds, at mid-adolescent stages, will respond to a stimulus lasting only 20 seconds.

4. The latent time shows relatively little specific difference, but is strikingly distinct generically. *Osmunda* responds about three times as quickly as *Asplenium.*

5. Presentation time and latent time for ferns may be represented by physiological graphs here termed graviscripts ; and certain generalisations with regard to them are suggested.

6. The data at present available point to latent time as in general a far more constant quantity than presentation time. In a fern frond it is at its minimum, and approximately constant throughout the adolescent stages.

7. It is pointed out that, since all characters possess taxonomic value in a truly Natural System, in cases of doubtful affinity, where easily available criteria have been found inconclusive, recourse may be had to physiological data.

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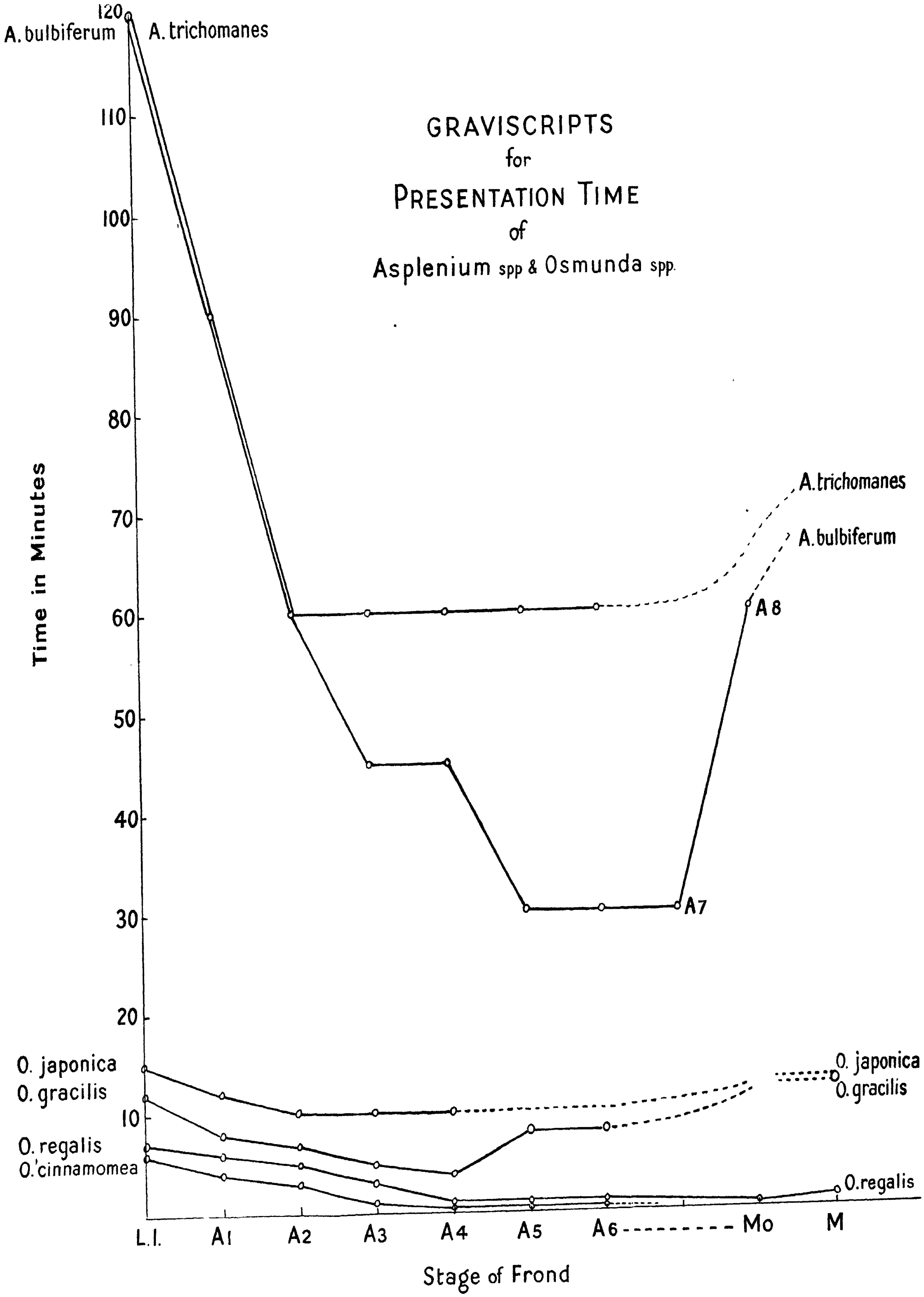
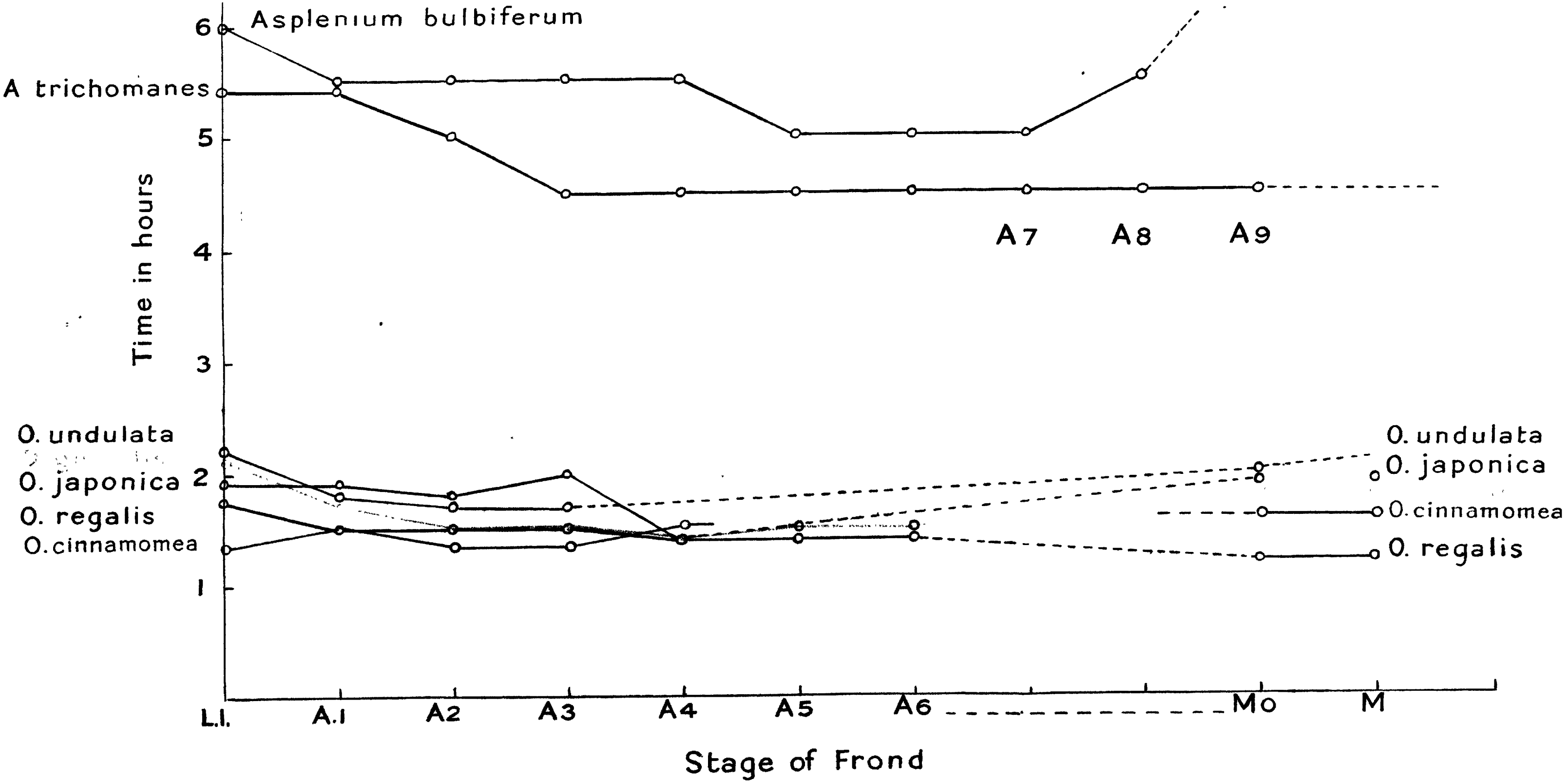
PRANKERD.

JOURN. LINN. SOC., BOT. VOL. XLVIII, PL. 14



N.B O. undulata L.I – A_2, closely approximates to O. cinnamomea,– later stages uncertain.

GRAVISCRIPTS for LATENT TIME of Asplenium spp & Osmunda spp.



A Revision of the Australian Species of *Frankenia*. By V. S. SUMMERHAYES B.Sc. (Lond.). (Communicated by Dr. A. W. HILL, C.M.G., F.R.S.)

(PLATES 16–19, and 7 Text-figs.)

[Read 1st November, 1928.]

HISTORICAL SUMMARY.

The first species of *Frankenia* discovered in Australia was *F. tetrapetala* Labill., a Western Australian species, described in 1804 (Labill. Pl. Nov. Holl. i, 88, t. 114). In De Candolle's 'Prodromus' (i, 350, 1824) two more endemic species were added, namely *F. pauciflora* DC. and *F. fruticulosa* DC., while the cosmopolitan *F. pulverulenta* L. was also recorded. The first two new species from Eastern Australia were very briefly described by Lindley in 1848 (Mitch. Journ. Trop. Austral. 305) from the Queensland collections of the then Surveyor-General of New South Wales, Lt.-Col. Sir T. L. Mitchell. In 1854, Turczaninov (Bull. Soc. Nat. Mosc. xxvii, 2, 367–368), who had purchased a set of Drummond's extensive Western Australian collections, described four more species, one of which, *F. parvula*, a very distinct plant, has not been re-discovered.

In 'Flora Australiensis' (i, 150, 1863), Bentham gave the first general account of the genus in Australia. He recognized in all only seven species, including a new one, *F. Drummondii*, reducing several of the previously-described ones and grouping a large number of forms under the polymorphic *F. pauciflora*. With the exception of two new species from Western Australia, described by Diels in 1904 (Engl. Bot. Jahrb. xxxv, 388–390), and one by W. V. Fitzgerald (Journ. W. Austral. Nat. Hist. Soc. i, 3) in the same year, nothing more was written on the Australian members of the genus until the year 1918.

In this year two revisions of the Frankenias of different Australian States were published. Ostenfeld (Dansk Bot. Arkiv, ii, 47–55) dealt with the Western Australian species, adding four new ones, while J. M. Black (Trans. Roy. Soc. S. Austral. xlii, 175–180) treated the South Australian Frankenias in a similar manner, three new species being recorded. Both papers are valuable contributions to our knowledge of the genus, and cleared up part of the extraordinary confusion into which the genus had gradually lapsed.

This confusion, which it would be difficult to exaggerate, has resulted from the great similarity in habit between the species, the very incomplete descriptions of those first described, and the fact that the types are scattered among nine different herbaria in Europe and Australia. In attempting to name the material at Kew according to the revisions by Black and Ostenfeld, it was soon realized that no further progress could be made until all the Australian species of the genus had been subjected to a thorough revision. A detailed investigation has therefore been undertaken, of which the following account is the result.

In carrying out the work, type-specimens or duplicates of all the Australian species were assembled, while the whole of the material at the herbaria at Kew, the British Museum, Berlin, Copenhagen, and the Herb. Delessert has been examined. In addition, extensive material from Australia, including the entire collections at Adelaide, Brisbane, and Perth, and many duplicates from Sydney, Melbourne, and Hobart, has been lent to the Royal Botanic Gardens, Kew, and has passed through my hands. I should here like to tender my cordial thanks to the authorities at all the institutions above mentioned for affording facilities for the examination of this material, and to the Director of the Musée de l'histoire naturelle at Paris for fragments of several types. When it is mentioned that in all the collections 50 to 80 per cent. of the specimens were incorrectly named, some idea of the confusion into which the genus had fallen may be obtained. A similar percentage of the specimens cited in the literature are erroneously determined. For example, thirteen different species have been erroneously included under *F. pauciflora* and eight under *F. serpyllifolia.* Hence it seems essential to supply detailed descriptions of all the species both old and new. As a result of the present revision, the number of Australian species has been doubled, 45 now being recognized, including the introduced *F. pulverulenta.*

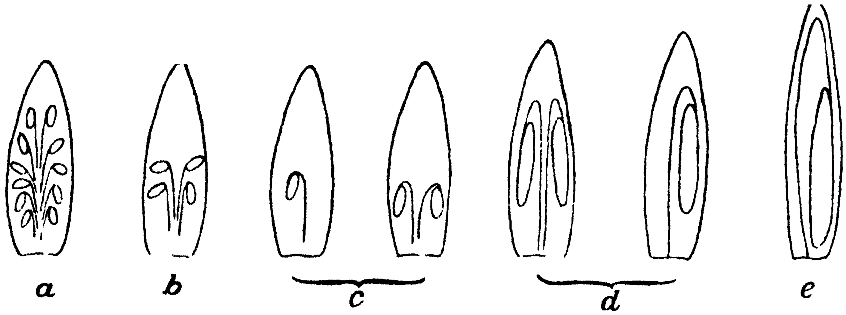
The earlier writers on *Frankenia* made no attempt to subdivide the genus, but in Engler and Prantl's 'Pflanzenfamilien' (iii, Abt. 6, 286–289, 1895) Niedenzu proposed two subgenera: I, *Afra* and II, *Oceania*, each defined by a combination of about seven associated characters. The subgenus *Afra* occurs in the Mediterranean Region, Western Asia, and Africa, while the distribution of the subgenus *Oceania* is Australia and America. Inspection of Niedenzu's scheme shows that subgenus *Oceania*, sect. Toichogonia, subdiv. A *a*, possesses two of the characters of subgenus *Afra*, namely a short calyx and a short ovary. Examination of the species assigned by him to the two subgenera, and of allied species, proves that the subgeneric characters selected by him do not hold good, and that they were based on a very incomplete knowledge of the species, especially of the Australian ones. In the second edition of the 'Pflanzenfamilien' (xxi, 279, 1925) numerous additional species were included. Several of these, e. g. *F. punctata* and *F. tetrapetala*, have perfectly sessile leaves, although subgenus *Oceania*, in which Niedenzu places them, is characterized, *inter alia*, by petiolate leaves. *F. pauciflora* and *F. conferta*, also assigned by him to *Oceania*, have long decurrent stigmas, a character of *Afra*; in other species of *Oceania*, e. g. *F. punctata*, the shape and length of the stigmas are highly variable. Subgenus *Oceania* is further defined as having the bracteal and bracteolar sheaths free from each other, but *F. palmeri* and *F. ambita*, which Niedenzu includes in it, have the bracteal and bracteolar sheaths adnate. Numerous other examples might be given. The subgenera *Afra* and *Oceania*, as the names themselves suggest, represent merely geographical divisions of the genus, and cannot be regarded as natural groups.

Niedenzu divided his subgenus *Oceania* into two sections :—

1. Toichogonia, with numerous ovules on parietal placentas ; and 2. Basigonia, in which there is a single basal ovule on each placenta, the funicle being elongated and bent over above, so that the ovule is suspended from it.

These sections were adopted by Ostenfeld and Black in their revisions, and were at first accepted by the writer; but, as more material was examined, it became evident that they also are untenable as natural groups. It is very easy to see the differences between the numerous, definitely parietal, mostly erect ovules of *F. pauciflora* and the three large basal ovules of *F. serpyllifolia*, with their long bent funicles ; but there are many species, such as *F. cordata*, *F. tetrapetala*, *F. densa*, and *F. interioris*, in which the placentation is intermediate in character, so that the section to which each should be assigned is largely a matter of opinion. Careful comparison has shown that there is a series of ovular arrangements leading from the typical parietal and multiovulate to the typical basal condition. Drawings of some of these will be found on text-fig. 1.

TEXT-FIG. 1.



Arrangement of the ovules in various species. *a. Frankenia pauciflora* DC. *b. F. cinerea* A. DC. *c. F. cordata* J. M. Black. *d. F. interioris* Ostenf. *e. F. serpyllifolia* Lindl.

In view of the fact that only the Australian species are here dealt with, I have made no attempt to divide the genus as a whole into sections, but have arranged the Australian species in eleven series according to their probable relationships (see p. 347).

MORPHOLOGY AND TAXONOMY.

Almost all the Australian species are dwarf shrubs, often with a creeping habit, but a few are annual herbs, such as the introduced *F. pulverulenta* and the remarkable dwarf *F. annua*. Most of them are found in localities with soil rich in saline substances, but Osborn has indicated that *F. serpyllifolia* may be present in communities which are definitely not halophytic. A few of the species, e. g. *F. pauciflora* and *F. ambita*, are almost entirely confined to the sea-coast, although not necessarily occurring in the intertidal zone.

In *Frankenia* the leaves are of great taxonomic importance. In the Australian species, as in the genus generally, they are small, simple, and often either rolled up or more or less terete and fleshy. A few species, especially in eastern Australia, have conspicuously flattened leaves. Whether the leaves are petiolate or not is a feature not easily determined except by a careful examination, but is nevertheless of great taxonomic value. For the purposes of the clavis, I have divided the leaves into three types, namely petiolate, subsessile, and sessile. In attempting to determine to which of these groups a leaf belongs, consideration should be given to the stipular sheath. The stipules are adnate to the leaves, and unite each pair of them, forming a sheath encircling the stem. There seems to be little doubt that the stipules were originally attached to the leaf at its base only, and that the adnate condition is derivative. As evidence of this, the fact may be mentioned that in the sessile leaves the sheath is adnate to the lamina, a most unusual condition. In deciding, therefore, whether a leaf is petiolate or not, the height of the centre of the sheath is subtracted from the total distance from the point of insertion to the base of the lamina (see text-fig. 2). When this difference is very small or *nil* the leaf is considered subsessile (text-fig. 2, *b*). A leaf is only considered sessile when the lamina is

TEXT-FIG. 2.

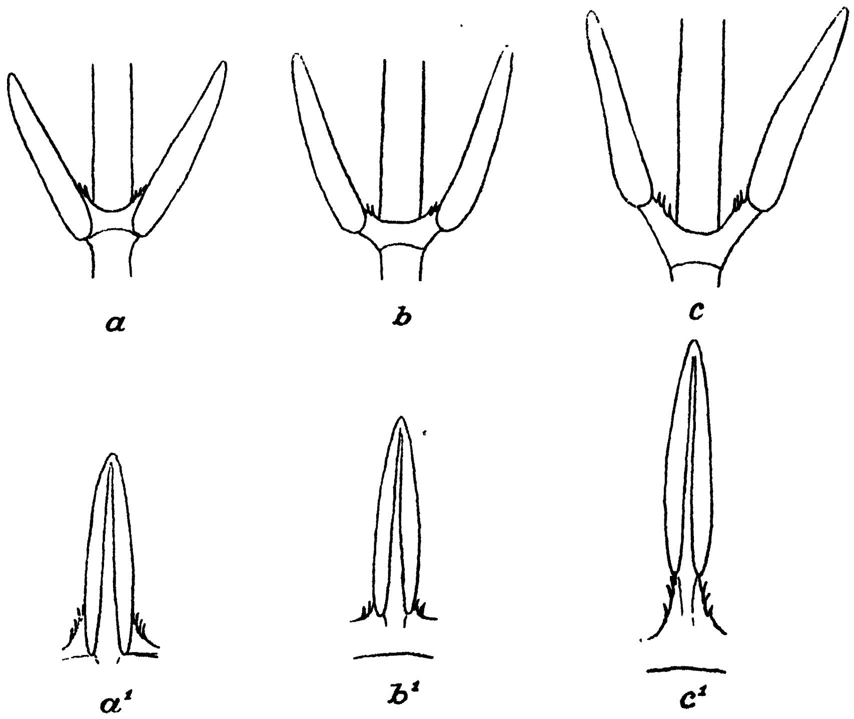


Diagram to show different types of leaves. *a*, a^1. Sessile—*F. sessilis* Summerh. *b*, b^1. Subsessile—*F. interioris* Ostenf. *c*, c^1. Petiolate—*F. pauciflora* DC.

inserted directly on the stem (text-fig. 2, *a*). Truly sessile leaves are found only in a very distinct group of closely-allied species.

Very characteristic salt-glands are found on the leaves (sometimes on other parts also) of most species of *Frankenia*, and may be sunk in such deep pits that the leaf appears very markedly punctate. Often the excreted salts completely cover the surface of the leaves, giving them a whitish or greyish appearance. The formation of such a crust occurs only on leaves that are pilose, and is due to the hairs holding the salt; in species with glabrous leaves the deposit of salt is confined to the vicinity of the glands.

The flowers are generally borne in dichasial cymes, these being rarely quite regular. Frequently the dichasial nature of the inflorescence is masked by the partial or complete failure of one of the branches to develop; but true monochasia are never formed. In some species the cymes are branched but once, producing only three flowers, while less frequently the flowers are solitary; but no case has been found in which the latter condition is constant. The flowers are always sessile, and in some cases the bracteolar sheath is fused to the base of the calyx. In the case of those species in which the flowers are in close heads, the lamina of one or both of the bracteoles is reduced or absent, but the petiole can be distinguished.

The floral leaves show remarkable meristic variation, so much so that the number of parts can be used only with reserve in distinguishing the species. The variation of the sepals and petals is usually correlated, but there may be no relation between this and the variation in the andrœcium and gynæcium. The formula K (4–6), C 4–6, A 3–8, G (2–4) represents the amount of variation found in the different parts.

The indumentum of the outside (and more rarely of the inside) of the calyx is a valuable diagnostic character, but the shape of the calyx-lobes seems of little significance. The petals, which are broadly or narrowly spathulate, sometimes ribbon-like, and in other cases with the limb almost fan-shaped, cannot be used as precise specific indicators except in a few species, while the scale on the inside of the claw, although absent in *F. glomerata*, in other species varies so much from one petal to another on the same plant as to be almost valueless.

The stamens show no marked variations in form. In dried specimens the filaments may sometimes appear to be united in various degrees, and in certain species, e. g. *F. connata*, *F. conferta*, have been described as connate, but, after long soaking in cold water, they can easily be separated. J. M. Black has pointed out (Trans. Roy. Soc. S. Austral. l, 285, 1926) that specimens which when fresh had free filaments may in the dry condition show apparently united ones. The anthers seem to be variously coloured when fresh, but owing to unsuitable material and to the absence of collectors' notes as to colour in most cases, I was unable to correlate anther colour with other characters. This is a line of work in the field which might yield valuable results.

In the gynœcium, besides the arrangement of the ovules, the shape of the stigma seems to be of importance, since differences in it are often associated with differences in other parts of the plant. The stigmas vary in shape from almost capitate to filiform, it being frequently difficult in the latter cases to determine their exact length. The seeds often afford valuable diagnostic characters, as in some cases they are smooth and glabrous and in others strongly papillose or pubescent. In certain species, e. g. *F. pauciflora*, both smooth and papillose seeds may be found, but, even so, they are all of one type on any given individual. In other species, so far as my observations go, only one type of seed occurs.

In view of the fact that in *Frankenia* related species differ from one another in a very large number of small characters instead of in a few large ones, it has been found necessary to supply more detailed descriptions than are usually given in other genera.

GEOGRAPHICAL DISTRIBUTION.

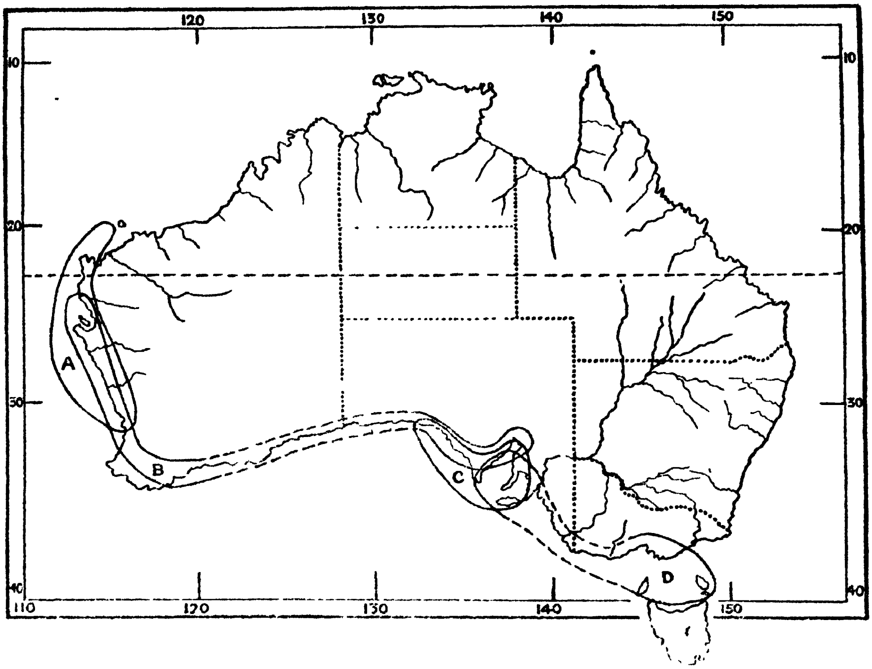
The distribution of the species offers several interesting problems for solution, but the chief fact which emerges is that many more records must be made before any really clear idea of the origin or arrival and of the spread of *Frankenia* in Australia, or even of the actual distribution of the species, can be obtained. This is illustrated by *F. conferta*, the two records for which are from the south-western region of Australia and from Central Australia, a distribution which appears to require confirmation. In several cases, e. g. *F. parvula* and *F. adpressa*, the exact localities are unknown.

The genus is found all over the continent south of latitude 17° or 18° S., with the exception of the Tasmanian mainland and the coastal regions of New South Wales and Queensland. It is therefore characteristic of the Mediterranean and Desert zones of Australia, thus affording a parallel to its distribution in other parts of the world. Western Australia and South Australia contain the greatest number of species (16 each), while the figures for the other States are as follows :—New South Wales 8 species, Queensland 6, Central Australia 5, Victoria 3, Tasmania (islands in Bass Strait only) 1 species; Northern Australia none. No doubt these numbers will be slightly increased as further field-work is carried out, for instance, *F. serpyllifolia* might be expected to occur in Central Australia.

F. pauciflora is the species with the widest distribution, since it extends along the coast from Dampier Archipelago, in north-western Australia, to Port Albert, 150 miles east of Melbourne (see text-fig. 3). Only four other species (*F. serpyllifolia*, *connata*, *gracilis*, and *hamata*) are common to three States, while no fewer than 24 species are up to the present recorded from one State only. This number will probably be reduced in course of time, but it indicates very clearly the extremely restricted distribution of the several species, a feature which *Frankenia* shares with many other genera in Australia.

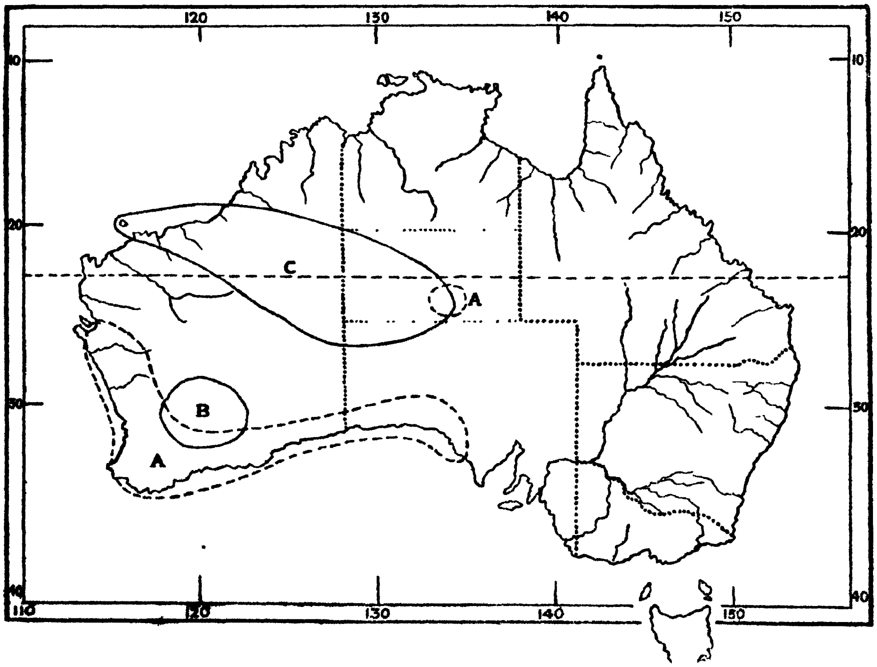
There are various reasons for assuming that the genus has spread from Western Australia eastwards. The figures for species in the different States

TEXT-FIG. 3.



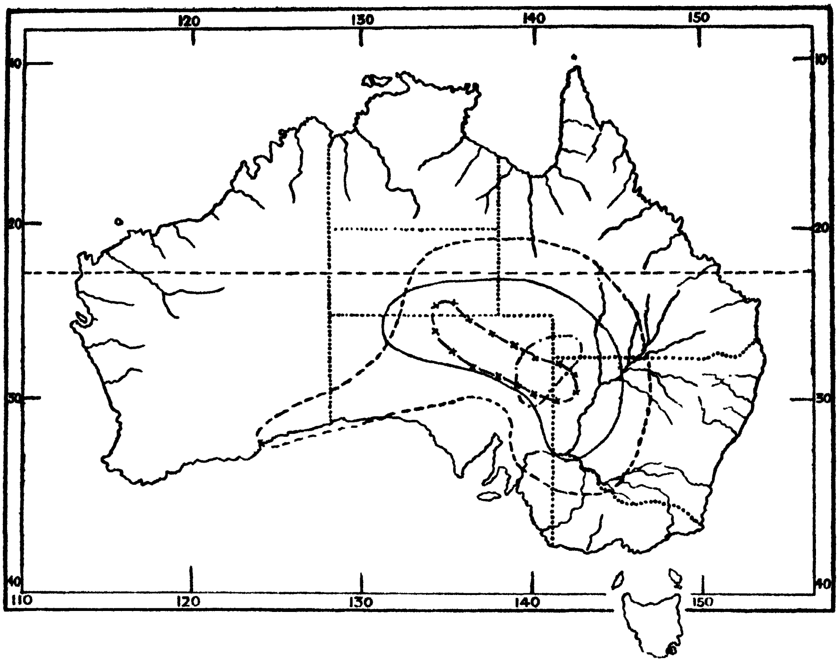
Distribution of the chief varieties of *Frankenia pauciflora* DC. A. Typical. B. var. *longifolia*. C. var. *fruticulosa*. D. var. *Gunnii*.

TEXT-FIG. 4.



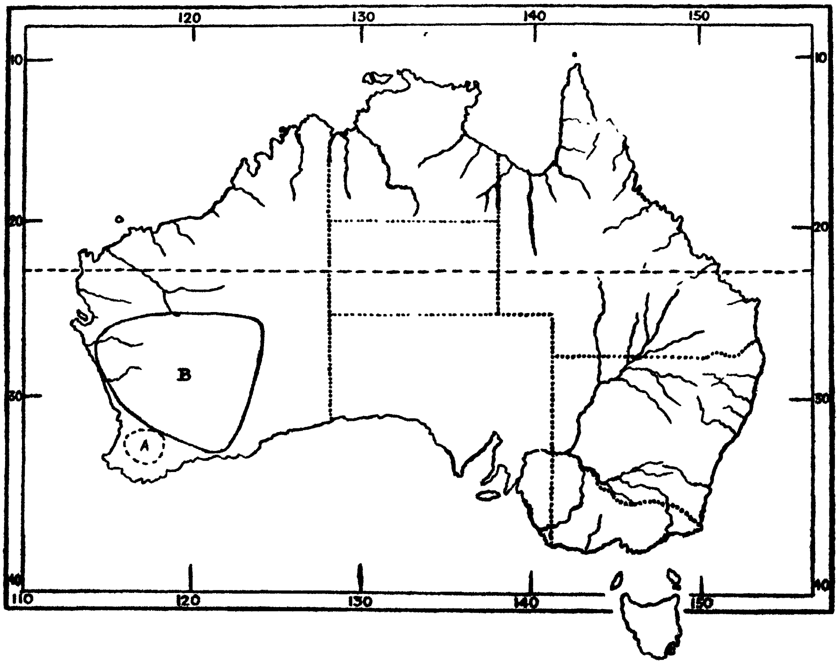
A. Distribution of § 1. Sessiles. B. § 2. Lanceolatæ. C. § 3. Cordatæ.

TEXT-FIG. 5.



– × - × - × Distribution of § 6. Cinereo-puberulæ.
· - · - · - · ,, ,, § 7. Intermediæ.
- - - - - - ,, ,, § 8. Pubescentes.
———— ,, ,, § 9. Uncinatæ.

TEXT-FIG. 6.



A. Distribution of § 10. Glabræ. B. § 11. Glomeratæ.

suggest a western origin, and this is supported by the presence in Western Australia of species of very diverse affinity. In spite of the equality in numbers, the species in South Australia are of a more uniform type than those in Western Australia. Furthermore, the majority of the species in the eastern States are of a rather advanced type, with a limited number of basal ovules (Sect. Basigonia Ndz.). The difficulty of separating many of the species of § Pubescentes and § Uncinatæ suggests that these groups are at present in an active state of differentiation following a relatively recent invasion of a region containing a great diversity of habitats, both climatic and edaphic. The distribution of all the series except 4 and 5 is shown on the accompanying maps (text-figs. 4–6).

EVOLUTION OF THE GENUS.

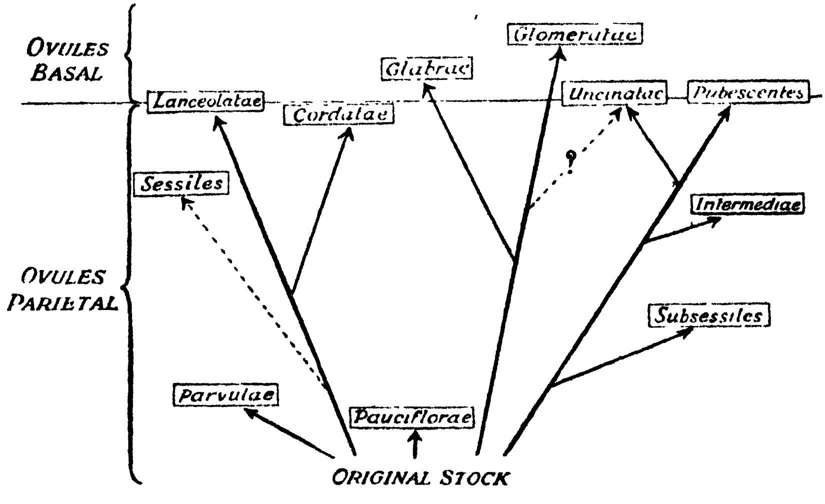
Any remarks made on this subject must of necessity be highly speculative in the present state of our knowledge of the causes and course of evolution in Phanerogams. Bray (Engl. Bot. Jahrb. xxiv, 396–417, 1898) has studied the geographical distribution of the whole family, and drawn therefrom conclusions as to the course of evolution in the genus *Frankenia*. Unfortunately, many of the data on which he relied were based on erroneous determinations, and consequently some of his conclusions with respect to the Australian species are no longer tenable. His main hypothesis, that the species with many parietal ovules, large seeds, and large flowers, including his *Eufrankenia* and *Toichogonia cosmopolita*, are a relatively recent development of the genus, seems to be a result of the then insufficient knowledge of *Basigonia* and *Toichogonia isolata* (species with many parietal ovules and small flowers) in Australia, where these two groups predominate. Most students of phylogeny will agree that in the Frankeniaceæ the presence of a limited number of basal ovules probably represents a more advanced stage in floral development than the presence of many parietal ones. Since in Australia there can be recognized a number of groups in which, associated with a more or less constant and definite leaf-form, there is a gradual reduction in the number of ovules, it seems only reasonable to infer that the *Basigonia* have been derived from forms with many parietal ovules. Species in which there are 1–3 ovules towards the base of each placenta, the funicles being slightly bent over, are frequent; while in typical "basigonial" groups cases are occasionally found in which one or two placentas bear two ovules, each with a long reflexed funicle: these may be considered as intermediates. It is also significant that among the species with basal ovules there are many forms which are advanced in other ways, such, for instance, as the grouping of the flowers in heads in § Glomeratæ.

The only three species of *Frankenia* with basal ovules found outside Australia are *F. Palmeri* Watson and *F. Jamesii* Torr., both from the western United States, and *F. Fischeri* Hicken, from Argentina. The first two are both very distinct from any Australian species with basal ovules, but resemble much more closely the widespread *Toichogonia*. As there are no species with parietal ovules in this region except the very different annual *F. grandifolia* Cham. & Schl., it may be inferred that the development to basal ovules is here complete.

The distribution and relationships of the Australian species seem to suggest that the *Basigonia* and *Toichogonia isolata* of Bray have been developed from the widely spread *Toichogonia cosmopolita*, represented in Australia by *F. pauciflora*. The presence of more or less similar species throughout the world may therefore be used as an argument for the relative age of this group, the *Basigonia* and other anomalous forms having been derived from these in response to special conditions. An interesting point in connection with this is the presence in § Uncinatæ, which is otherwise "basigonial," of *F. annua*, in which the numerous parietal ovules have been retained in correlation with its dwarf habit and annual duration. Considering the great differences in other characters between the species possessing small flowers, this latter character can scarcely be considered to indicate genetic relationship, and, indeed, the variation in floral size in § Sessiles, a very distinct group, suggests that it is not a stable character.

Although the general course of evolution suggested above is probably true, it is almost impossible to trace it through individual species except in a few cases. Some of the groups, such as § Sessiles, seem to have no near relatives. An attempt to indicate the general affinity between the groups is supplied in the following scheme :—

TEXT-FIG. 7.



Scheme showing the probable relationships of the different series of Australian Frankenias.

Certain characters, such as the aggregation of the flowers into heads, have been developed independently in a number of different groups in the genus. Aggregation of flowers is constant in § Glomeratæ with basal ovules, and in

F. conferta of § Sessiles with parietal ovules, and is often met with in other species—in fact, there seems to be a general tendency in the genus in this direction. The adnation of the lower portions of the calyx with the bracts and bracteoles to form a hollow, somewhat woody tube is also found in several species which are otherwise very different (e. g., *F. ambita*, *F. cupularis*); but the significance of this tendency is not as yet understood: it also occurs in the North American *F. Palmeri*. On the whole, § Glomeratæ may be considered as representing the most advanced type, as it is characterised by basal ovules, aggregation of flowers, and reduction in the number of parts, together with, in *F. bracteata*, clear differentiation between foliage leaves and bracts.

In conclusion, I should like to express my great indebtedness to Mr. T. A. Sprague, who first suggested to me the advisability of revising the Australian Frankenias and who has helped me in many ways during the course of the work. My thanks are also due to Mr. G. Atkinson for most of the plates and for text-fig. 7.

SYNOPSIS SERIERUM.

1. SESSILES.

Caules procumbentes, adscendentes, rarius erecti, multiramosi, internodiis sæpius brevibus. Folia *sessilia*, ±linearia, subteretia, marginibus revolutis, sulcata, sæpe cauli adpressa, interdum in appendicam liberam cauli adpressum deorsum producta; vagina sursum producta, folia ergo anguste alata. Bracteolæ foliis similes, sed interdum petiolatæ. Flores parvi (calyx ad 5 mm. longus) vel mediocres (calyx 5–8 mm. longus) rarissime capitati, 4–5-meri. Calyx tubulosus. Ovarium ovoideum vel ellipsoideum. Ovula semper parietalia, sæpius pauca sed interdum numerosa.—W. Austral., S. Austral., C. Austral., Vict. (map, text-fig. 4).—1. *conferta*, 2. *sessilis*, 3. *tetrapetala*, 4. *brachyphylla*, 5. *decurrens*, 6. *cinerea*, 7. *punctata* (p. 352).

2. LANCEOLATÆ.

Caules e caudice lignoso procumbentes ad erecti. Folia subsessilia vel brevissime petiolata, lanceolata vel lineari-lanceolata rarius linearia, marginibus ± sed raro ad medium revolutis; vagina ciliata. Flores magnitudine parvi vel mediocres, sæpius 5-meri. Calyx tubulosus. Ovula parietalia vel basalia.—W. Austral. (map, text-fig. 4).—8. *irregularis*, 9. *desertorum*, 10. *interioris* (p. 358).

3. CORDATÆ.

Caules procumbentes usque erecti, internodiis sæpius longiusculis. Folia subsessilia rarissime sessilia vel breviter petiolata, basi ±cordata, marginibus ±revolutis, supra fere glabra, subtus pilosa; costa subtus prominente. Flores parvi usque magni (calyx ultra 8 mm. longus), 5–6-meri. Ovula parietalia, 1–2 pro placenta.—W. Austral., S. Austral., C. Austral. (map, text-fig. 4).—11. *cordata*, 12. *speciosa*, 13. *ambita* (p. 360).

4. PARVULÆ.

Caules procumbentes, e nodis radicantes, internodiis brevissimis. Folia petiolata, brevissima, oblonga, subteretia, vaginis longis. Flores parvi, calyce superne longe setuloso-piloso. Ovula parietalia, numerosa.—W. Austral.—14. *parvula* (p. 363).

5. PAUCIFLORÆ.

Caules sæpius e basi lignosa erecti vel adscendentes, fasciculis axillaribus foliorum, internodiis sæpius longis. Folia petiolata, linearia, subteretia vel rarius plana, patentia, sæpe valde glanduloso-punctata ; petiolus ut vagina ciliatus. Flores mediocres vel magni, sæpius 5-meri. Ovula parietalia, numerosa. —W. Austral., S. Austral., Vict., Tasman.—15. *confusa*, 16. *pauciflora*, 17. *laxiflora*, 18. *fecunda*, 19. *magnifica* (p. 363).

6. CINEREO-PUBERULÆ.

Caules erecti usque procumbentes, foliosa, internodiis brevibus. Folia petiolata vel subsessilia, patentia, subteretia vel subplana, obtusissima, cinereo-puberula ; vagina ciliata, extra pubescens. Flores parvi vel mediocres, 5-meri, calyce puberulo, lobis breviter cuspidatis. Ovula parietalia, numerosa.—S. Austral., C. Austral., N.S.W. (map, text-fig. 5).—20. *subteres*, 21. *foliosa*, 22. *muscosa* (p. 369).

7. INTERMEDIÆ.

Caules procumbentes, internodiis mediocribus. Folia petiolata, supra sparse pilosa, marginibus ±revolutis ; vagina extra pubescens. Dichasia elongata. Flores mediocres, 5-meri. Calyx tubulosus, intus glaber ; lobi lanceolati, breviter cuspidati. Stamina 6 ; filamenta linearia. Ovula parietalia, numerosa. —S. Austral., Queensl.—23. *cupularis*, 24. *pseudo-flabellata*, 25. *adpressa* (p. 371).

8. PUBESCENTES.

Caules procumbentes usque erecti, sæpius dense pubescentes demum glabri. Folia petiolata, marginibus ±revolutis, supra dense pubescentia vel breviter rarius longe pilosa, costa subtus prominente ; petiolus ciliatus ; vagina extra pubescens. Dichasia pluries furcata ; bracteolæ vulgo foliis conformes. Flores parvi usque magni, 4–5-meri. Calyx tubulosus, extra pubescens, intus glaber. Ovula sæpius basalia, in una specie (*F. densa*) parietalia, pauca.—W. Austral., S. Austral., C. Austral., Queensl., N.S.W., Vict. (map, text-fig. 5).—26. *densa*, 27. *scabra*, 28. *angustipetala*, 29. *eremophila*, 30. *connata*, 31. *latior*, 32. *planifolia*, 33. *flabellata*, 34. *serpyllifolia* (p. 373).

9. UNCINATÆ.

Plantæ annuæ (*F. annua*) vel fruticuli. Caules procumbentes usque erecti, ±patentim uncinato-pilosi, demum glabri. Folia petiolata, marginibus

±revolutis, supra sæpius glabra, costa subtus prominente ; petiolus ciliatus ; vagina ciliata, sæpius extra uncinato-pilosa. Bracteolæ foliis superioribus conformes. Flores mediocres vel magni, 5-meri. Calyx tubulosus, extra costis ±uncinato-pilosis, inter costas pilosulus. Ovula basalia specie annua ovulis numerosis excepta.—S. Austral., C. Austral., Queensl., N.S.W., ? Vict. (map, text-fig. 5).—35. *annua*, 36. *gracilis*, 37. *uncinata*, 38. *hamata*, 39. *Stuartii* (p. 379).

10. GLABRÆ.

Caules procumbentes, e nodis radicantes, internodiis brevibus. Folia petiolata. marginibus ±revolutis, supra glabra, nitida. Flores parvi vel mediocres, 5 meri, calyce glabro. Ovula basalia.—W. Austral. (map, text-fig. 6).—40. *Drummondii* (p. 382).

11. GLOMERATÆ.

Caules e caudice lignoso adscendentes vel erecti, fasciculis axillaribus foliorum, internodiis sæpe longis. Folia petiolata, anguste linearia, subteretia, sulcata. Flores in dichasiis capituliformibus (*F. Georgii* excepta), mediocres, 4–5 meri. Calyx tubulosus. Ovula basalia.—W. Austral. (map, text-fig. 6).—41. *Georgii*, 42. *setosa*, 43. *glomerata*, 44. *bracteata* (p. 383).

Clavis specierum.

Ovula parietalia, 1 vel ultra pro placenta, funiculis brevibus erectis vel superne breviter refractis.
Folia sessilia (text-fig. 2, *a*) vel subsessilia (text fig. 2, *b*).
Flores ad apices ramulorum capitatim dispositi ; folia 2-5 mm. longa, vix 1 mm. lata, subtus sulcata .... 1. *conferta*.
Flores in dichasiis ±laxis dispositi vel solitarii, haud capitati.
Vagina communis bractearum et bracteolarum elongata, tubulosa, basin calycis amplectens et eæ adnata.
Folia lanceolata vel lanceolato-ovata, basi ±cordata, 1·5 4·5 mm. lata ; calyx 7-9 mm. longus .... 12. *speciosa*.
Folia sæpius linearia vel lineari-lanceolata, basi subrotundata, 0·5-2 mm. lata ; calyx 4-6 mm. longus .... 13. *ambita*.
Vagina communis bractearum et bracteolarum ubi adest brevis, nec tubulosa nec calyci adnata.
Folia e nodo deorsum producta, 1·5-6 mm. longa.
Calyx intus basi longe adpresse pilosus ; bracteolæ sæpius vaginæ bractearum adnatæ .... 6. *cinerea*.
Calyx intus glaber vel sparse puberulus ; bracteolæ sæpius a vagina bractearum liberæ.
Folia 2-4 mm. longa, e nodis deorsum per 0·5-2 mm. producta, cauli ±adpressa .... 7. *punctata*.
Folia 3-6 mm. longa, basi leviter decurrentia, patentia, 5. *decurrens*.
Folia basi non deorsum producta.
Folia basi cordata, supra glaberrima, valde punctata .... 11. *cordata*.

Characteres haud ut supra associati.
Folia patentia vel reflexa, versum apicem quam alibi latiora vel saltem haud angustata, obtusissima, dense pubescentia.
Planta humilis, repens, pulvinata; folia 1–3·5 mm. longa .... 22 *muscosa.*
Fruticulus, ±erectus; folia 2-7 mm. longa ...... 21. *foliosa.*
Folia rarissime patentia, et tunc glabra vel versus apicem angustata.
Folia subsessilia; ovula 8–11 pro placenta .... 8. *irregularis.*
Folia sessilia; ovula 1–4 pro placenta.
Folia supra fere glabra; calyx extra partibus intercostalibus pilosis exceptis glaber.
Planta repens, caulibus e nodis radicantibus, ramis brevibus erectis; folia 2–5 mm. longa; sepala petalaque semper 5-mera .. 4. *brachyphylla*
Caules erecti, adscendentes vel procumbentes, e nodis rarissime radicantes; folia 2–9 mm. longa; sepala petalaque sæpius tetramera.. 3. *tetrapetala.*
Folia supra glabra; calyx extra dense minute pubescens; planta cinerascens .... 2. *sessilis.*
Folia petiolata (text-fig. 2, *c*).
Folia parva, 1·5–3 mm. longa, curvata; vagina magna, valde persistens; calyx superne longe setuloso-pilosus, inferne glaber. 14. *parvula.*
Characteres haud ut supra associati.
Vagina communis bractearum et bracteolarum breviter tubulosa, basin calycis amplectens .... 23. *cupularis.*
Vagina communis bractearum et bracteolarum haud tubulosa.
Calyx extra longe patentim setuloso-pilosus; folia linearia vel oblongo-linearia, primum dense setuloso-pilosa, demum glabra; flores magni, calyce ultra 7 mm. longo.. 19. *magnifica.*
Calyx extra sparse adpresse setuloso-pilosus; folia elliptico-ovata usque lineari-oblonga; flores parvi vel mediocres, calyce haud 7 mm. longo.
Rami divaricati, laxi; folia ut calyx sparsissime adpresse pubescentia .... 25. *adpressa.*
Rami crebri, foliosissimi; folia (et calyx minus) patentim pubescentia .... 24. *pseudo-flabellata.*
Calyx extra fere glaber vel breviter pubescens.
Planta humilis, repens; caules multiramosi, internodiis brevissimis; folia lanceolata, breviter pubescentia; calyx breviter pubescens .... 26. *densa.*
Characteres haud ut supra associati.
Folia oblonga usque obovata, glabra; plantæ annuæ.
Calyx 3·5–4 mm. longus; petala circiter 4 mm. longa, ligulato-spathulata, limbo angusto, ungue lato; planta maritima, caulibus procumbentibus .... 45. *pulverulenta.*
Calyx ultra 5 mm. longus; petala ultra 7 mm. longa, obovato-spathulata, limbo 2·5–3·5 mm. lato; planta interioris Novæ Hollandiæ, caulibus erectis 35. *annua.*

Folia oblonga usque linearia et subteretia, inferiora interdum applanata sed haud obovata; plantæ sæpius perennes.

Folia linearia, subteretia, subtus profunde unisulcata, costa elevata, sulco igitur basi in sulcos duos minores diviso.

Folia supra dense scabrido-pilosula, profunde punctata; petala ultra 13 mm. longa, ungue circiter 1 mm. lato .... 18. *fecunda.*

Folia pubescentia vel glabra, interdum punctata sed characteres haud ut supra associati.

Folia pallide fulvo-cinerea, fere teretia, obtusissima, supra minute pubescentia; caules erecti; flores ad apices ramulorum terni .... 20. *subteres.*

Species polymorpha; folia præsertim subteretia, interdum pauca eorum plana, glabra vel rarius ±pubescentia: caules procumbentes usque erecti; flores in dischasiis longis pluries furcatis dispositi .... 16. *pauciflora.*

Folia satis plana, costa et parte majore paginæ inferioris obviis.

Folia inferiora oblonga, usque ad 3 mm. lata, superiora basi rotundata vel fere cordata; species Australiæ boreali-occidentalis incola .... 15. *confusa.*

Folia inferiora oblongo-linearia, sæpius usque ad 1·5 (rarius ad 2) mm. lata.

Dichasia laxa, ramis divaricatis; bracteæ et bracteolæ minutæ; calyx ±fusiformis; caules erecti .... 17. *laxiflora.*

Dichasia sæpe densa, interdum laxa, sed semper foliosa; bracteæ et bracteolæ magnæ; calyx tubulosus; caules procumbentes vel adscendentes .... 16. *pauciflora.*

Ovula basalia sæpius 2-3 (*i.e.*, 1 pro carpello), rarius 4-5, funiculis longis superne refractis, micropyle superiore.

Flores ad apices ramorum capitatim dispositi.

Folia supra glaberrima, 4-11 mm. longa.

Bracteæ foliis dissimiles, planæ; calyx setuloso-pilosus...... 44. *bracteata.*

Bracteæ foliis similes: calyx glaber vel pilis paucis debilibus instructus .... 43. *glomerata.*

Folia præsertim juventute supra scabrido-pilosa, 3-7 mm. longa; calyx ±dense setuloso-pilosus .... 42. *setosa.*

Flores in dischasiis ±laxis interdum apice densis dispositi.

Folia subsessilia (species Australiæ Occidentalis incolæ).

Calyx ut folia dense recurvato-pubescens .... 10. *interioris.*

Calyx sparse pubescens, folia fere glabra .... 9. *desertorum.*

Folia sæpius distincte petiolata.

Folia supra glabra vel fere glabra.

Folia, calyces et rami haud uncinato-pilosi.

Caules procumbentes, e nodis radicantes, glabri vel sparse setuloso-pilosi; stigmata minuta, clavato-capitata .. 40. *Drummondii.*

Caules erecti, dense pubescentes; stigmata linearia, 1 mm. longa .... 29. *eremophila.*

Rami vel calyces, vel sæpius ambo, et folia rarius uncinato-pilosi.

Folia linearia, subteretia.

Stigmata linearia, circiter 1 mm longa; stamina 6 .... 36. *gracilis.*

Stigmata clavata, 0·2–0·3 mm. longa; stamina 4 ...... 48. *Georgii.*

Folia omnia vel inferiora saltem ±plana, lanceolata, oblonga vel elliptica.

Stigmata clavata usque linearia, 0·3–0·5 mm. longa; folia inferiora 1–2 mm. lata .... 37. *uncinata.*

Stigmata linearia vel filiformia, 0·8–1·5 mm. longa; folia inferiora 3–4 mm. lata .... 38. *hamata.*

Folia supra ±dense pubescentia vel pilosa.

Folia et rami uncinato-pilosi .... 39. *Stuartii.*

Folia et rami interdum curvato- nunquam uncinato-pilosi.

Folia ±longe setuloso-pubescentia; stigmata clavata vel capitata, sæpius 0·2–0·5 mm. longa .... 34. *serpyllifolia.*

Folia breviter pubescentia; stigmata longa vel brevia.

Folia et bracteæ late ovatæ, elliptico-ovatæ vel oblongo-ellipticæ; stigmata ultra 1 mm. longitudine ...... 32. *planifolia.*

Folia superiora linearia vel lanceolata, inferiora interdum oblonga vel elliptica sed pro rata angustiora quam in specie præcedente.

Calyx 6·5–10 mm. longus; stigmata linearia vel filiformia, 0·7–2 mm. longa.

Folia omnia linearia vel oblongo-linearia .... 30. *connata.*

Folia inferiora elliptica vel oblonga .... 31. *latior.*

Calyx 3–7 mm. longus; stigmata capitata, clavata vel breviter linearia, 0·3–1 mm. longa.

Folia linearia, subteretia; stigmata capitata ...... 27. *scabra.*

Folia linearia usque oblongo-elliptica; stigmata breviter linearia.

Petala late flabellato-spathulata; stigmata 0·2–0·5 mm. longa .... 33. *flabellata.*

Petala obovato-spathulata; stigmata 0·3–1 mm. longa .... 28. *angustipetala.*

ENUMERATION OF SPECIES.

§ 1. SESSILES.

1. F. CONFERTA Diels in Engl. Bot. Jahrb. xxxv, 389 (1904); Ostenfeld in Dansk Bot. Arkiv, ii, 51 (1918).

Caules ad 17 cm. longi, ramis longiusculis simplicibus, dense breviter pubescentes et sparsissime uncinato-pilosi, demum glabri, internodiis ad 1·7 cm. longis. *Folia* linearia, acuta vel obtusa, 2·2–5 mm. longa, 0·7–1 mm. lata, supra dense brevissime pubescentia, crusta cinerea obtecta, subtus densissime albo-pubescentia; vagina ciliata. *Flores* in dichasiis confertis capitatis

3–9-floris. *Bracteolæ* sessiles vel breviter petiolatæ, interdum ad vaginam reductæ, ad 2·7 mm. longæ, 0·8 mm. latæ. *Calyx* 4–4·7 mm. longus, 1·3–1·4 mm. diametro, 5-costatus, extra breviter pubescens, intus glaber; lobi ovati vel lanceolati, subacuti vel acuti, 0·5–0·8 mm. longi, basi 0·5–0·8 mm. lati, conduplicati, cuspide solida 0·2–0·3 mm. longa. *Petala* 5, ligulato- vel cuneato-spathulata, 6–8 mm. longa; limbus 2·8 mm. longus, 1·2–1·5 mm. latus. *Stamina* 6; filamenta linearia, 4–7 mm. longa, 0·2–0·4 mm. lata, superne subulata; thecæ 0·9–1·1 mm. longæ. *Ovarium* 1·5–2·3 mm. longum, trimerum; stylus 4–5 mm. longus, parte communi 3 mm. longa, ramis tribus 1·3–2·3 mm. longis; stigmata linearia vel filiformia, 0·5–1·2 mm. longa; ovula 17–19 (5–7 pro placenta) 0·3 mm. longa. *Capsula* 2·5 mm. longa; semina 8–14, trigono-ovoidea, 0·6–0·7 mm. longa, breviter pubescentia.

WESTERN AUSTRALIA. Without exact locality, 1890, *Mrs. Heal* (Diels 7836, Herb. Berol.) (type).

CENTRAL AUSTRALIA ? Little River, 1924 ? *Ewart.*

Diels suggests that the type-specimen came from Avon District in Western Australia. If this is so, the distribution is remarkable, as the only other specimen so far recorded was found at least 600 miles away. I have not yet been able exactly to locate Little River, but it is probably somewhere near the trans-continental telegraph-line.

2. F. SESSILIS Summerhayes, sp. n.—*F. fruticulosa* J. M. Black in Trans. Roy. Soc. S. Austral. xli, 48 (1919); xlii, 178, t. xvii, figs. 11–14 (1918); Osborn in Trans. Roy. Soc. S. Austral. xlvi, 205 (1922); non DC. *F. tetrapetala* Diels & Pritzel in Engl. Bot. Jahrb. xxxv, 390 (1904), partim; J. M. Black in Trans. Roy. Soc. S. Austral. xl, 68 (1916); Ostenfeld in Dansk Bot. Arkiv, ii, 53 (1918); non Labill.

Caules inferne e nodis radicantes, superne multiramosi, inferne sæpe nudi, ad 30 cm. longi, caules ramique breviter dense pubescentes, demum glabri, internodiis sæpius brevissimis longioribus ad 1·4 cm. longis. *Folia* linearia, lineari-lanceolata vel oblongo-linearia, obtusa, acuta vel apiculata, nunquam rotundata, 1·5–4·8 mm. longa, 0·6–0·9 (1–1·1: *Mrs. Brown*) mm. lata, supra dense breviter pubescentia, sæpius crusta albida obtecta, subtus dense albido-pilosa; vagina ciliata, extra pubescens. *Flores* solitarii vel in dichasiis ±irregularibus, albi. *Bracteolæ* petiolatæ, 1·5–4·3 mm. longæ, 0·6–0·8 mm. latæ; petiolus applanatus, 0·3–0·7 mm. longus, superne pauciciliatus, vaginæ bractearum incomplete adnatus. *Calyx* 2·8–5 mm. longus, 0·7–1·5 mm. diametro, 4- (rarius 5-) costatus, extra ±dense breviter pubescens, intus glaber vel rarius sparse puberulus; lobi triangulari-ovati usque lanceolati, acuti, 0·3–1·5 mm. longi, basi 0·3–1·2 mm. lati, cuspidati, cuspide solida brevissima rarius ad 0·3 mm. longa, introrsum concavi vel conduplicati. *Petala* 4 (4–5: *Black, R. Brown* 5199), oblanceolato-spathulata usque late obovato- vel flabellato-spathulata, 4–6·8 (3·3–3·6: *Osborn*; 7·5–8: *Mrs. Brown*) mm. longa; limbus 1–4 mm. longus, 0·7–3·5 mm. latus (latitudinis differentia in singulis speciminibus nunquam ultra 0·5 mm.). *Stamina* 4 (4–6 : *Black*) ; filamenta linearia, 2·2–5·7 (6–6·5 : *Mrs. Brown*) mm. longa, 0·1–0·4 (0·5–0·7 : *Mrs. Brown*) mm. lata, superne subulata ; thecæ 0·5–0·9 mm. longæ. *Ovarium* 0·8–2·5 mm. longum, dimerum (2–3-merum : *Black*) ; stylus 2–4·2 (4·8–5·1 : *Black* ; 5 : *Mrs. Brown*) mm. longus, parte communi 1·5–3·5 (rarius –4) mm. longa, ramis 2 (2–3 : *Black*) 0·4–1·8 mm. longis ; stigmata linearia vel lineari-clavata, 0·2–0·8 mm. longa ; ovula 2, rarius 3 (3–5 : *Black*) (1–2 pro placenta), 0·3–0·6 mm. longa. *Capsula* 2·2–2·5 mm. longa ; semina 1–2, ovoidea vel ellipsoideo-ovoidea, 1–1·3 mm. longa, asperula vel in specimine unico minute papillosa.

SOUTH AUSTRALIA. Thevenard Peninsula, Great Australian Bight, Nov. 1915, *J. M. Black* 5! Ardrossan, 1879, *O. Tepper*! (Herb. Adel.). E. Franklin I., dry cliffs and travertine pavement, 11/1/1922, *Osborn*! Fowler's Bay, Nov. 1907, *Mrs. T. Brown*!

WESTERN AUSTRALIA. Eucla, *Okyn*! (*Diels* 7841, Herb. Berol.). Shore of Bay 3, 1802, *R. Brown* 5199! Israelite Bay, 1885, *Brooke*! (*Diels* 7840, Herb. Berol.). 60 k. N. of Esperance, on salty clayey-sand in a hollow, 60 m., Nov. 1901, *Diels* 5450!

Var. MAJOR Summerhayes, var. n. a typo speciei foliis bracteolisque longioribus, floribus majoribus differt.

Calyx 6·7 mm. longus. *Petala* 9 mm. longa. *Folia* 3–5·7 mm. longa. *Bracteolæ* 4·2–6·5 mm. longæ.

SOUTH AUSTRALIA. Le Hunte Bay, Sept. 1907, *R. S. Rogers* (type).

Perhaps only a luxuriant form, but with spreading leaves and rather different habit from that in the type. The flowers are much larger and tend to be pentamerous.

3. F. TETRAPETALA Labill. Pl. Nov. Holl. i, 88, t. 114 (1804) ; DC. Prodr. i, 250 (1824) ; Benth. Fl. Austral. i, 152 (1863) ; Diels & Pritzel in Engl. Jahrb. xxxv, 390 (1904), partim.

Caules sæpius ad 20 cm. (rarius ad 37 cm.) longi, præsertim superne multiramosi, ramis confertis foliosis, juventute dense breviter pubescentes, demum glabri, internodiis sæpius brevibus (ad 1 cm.) rarius ad 1·8 cm. longis. *Folia* linearia, acuta vel apiculata, 2–7 (rarius ad 9) mm. longa, 0·3–1 mm. lata, supra glabra vel rarissime leviter scabrida, sæpe nitentia, glandulis punctata, subtus dense albido-pilosula ; vagina glabra vel rarius extra sparse pubescens, apice pauciciliata. *Flores* solitarii vel in dichasiis paucifloris vel longioribus interruptis. *Bracteolæ* petiolatæ, 2·2–6 mm. longæ, 0·3–0·8 mm. latæ ; petiolus sæpius 0·4–0·8 (ad 1·2 : *Müller* ; *Maxwell*) mm. longus, applanatus, alatus, superne pauciciliatus. *Calyx* 4·3–6·5 mm. longus, 0·8–1·4 mm. diametro, 4–5-costatus, extra superne costis glabris, inter costas puberulus, inferne præsertim inter costas setuloso-pilosus, intus glaber vel breviter sparseque puberulus ; lobi lanceolati vel ovati, acuti, 0·7–1·4 mm. longi, basi 0·5–1 mm. lati, cuspidati, cuspide solida brevi rarius ad 0·4 mm. longa, introrsum concavi vel conduplicati. *Petala* 4–5, spathulata, obovato- vel flabellato-spathulata, 6·7–8·2 (rarius ad 10·5) mm. longa; limbus 2·6–3·8 (rarius ad 5·5) mm. longus, 1·5–3 mm. latus. *Stamina* 4–6; filamenta linearia, 4–7·8 mm. longa, 0·1–0·4 mm. lata, superne subulata; thecæ 0·7–1·1 (rarius ad 1·3) mm. longæ. *Ovarium* 1·2–2·6 mm. longum, 2–3-merum; stylus 4–6 mm. longus, parte communi 3–4·7 mm. longa, ramis duobus vel tribus 1–2·3 mm. longis; stigmata clavata usque linearia, 0·2–0·7 mm. longa; ovula 2–6 (1–3 pro placenta), parietalia (sed sæpe 0·5 mm. tantum supra basin valvæ affixa, funiculis sæpe longis et ovula tunc pendula), 0·2–0·5 mm. longa. *Capsula* unica tantum visa, ab insectis injuriata (*Drummond* 279); semina pyriformia, 1·7 mm. longa.

WESTERN AUSTRALIA. Probably near Mt. Barren, *Labillardière*! (type in Herb. Mus. Paris). Fitzgerald R., *Maxwell*! Larger I. of Goose I. Bay (nr. Middle Island) and at Bay 3 on South Coast, Feb. 1902, *R. Brown* 5198! King George's Sound, *Baxter*! "Swan River," *Drummond* 5th coll. 279! *Bauer* (ex Herb. Mus. Vind. 1837)! Newdegate, near Lake Grace, Dec. 1926, *C. A. Gardner*!

There seems to be no doubt that the type-specimen was collected by Labillardière in "terra Van-Leuwin" and not in "capite Van Dieman," since the point at which d'Entrecasteaux landed in the former area is almost at the centre of distribution of the species, as indicated by the other specimens.

4. F. BRACHYPHYLLA Summerhayes, sp. n.—*F. tetrapetala* Labill., var. *brachyphylla* Benth. Fl. Austral. i, 153 (1863); Diels & Pritzel in Engl. Bot. Jahrb. xxxv, 390 (1904).

Caules e nodis radicantes, ad 20 cm. longi, ramulis multis erectis vel adscendentibus, pubescentes, crusta alba obtecti, internodiis ad 1·4 cm. longis. *Folia* fusiformia vel linearia, ex apice obtuso vel acutiusculo obtuse apiculata; juxta basin sæpe leviter angustata, 2·2–4·8 mm. longa, 0·5–0·8 mm. lata, supra minute scabrido- vel curvato-pilosula, subtus densissime pubescentia; vagina extra minute puberula, apicibus ipsis 1–2-ciliata, ceterum eciliata. *Flores* solitarii vel in dichasiis pluries furcatis. *Bracteolæ* petiolatæ, 1·8–3·0 mm. longæ, 0·5–0·8 mm. latæ, petiolus applanatus, 0·5–0·7 mm. longus, dorso vaginæ bractearum varie adnatus vel liber. *Calyx* 5–6·3 mm. longus, 0·8–1·3 mm. diametro, 5-costatus, extra ad lobos et inter costas breviter setuloso-pilosus, costis fere glabris, intus glaber vel sparse puberulus; lobi lanceolati, acuminati, 1–2 mm. longi, basi 0·6–0·9 mm. lati, conduplicati, cuspide solida 0·2–0·7 mm. longa. *Petala* 5, late obovato- vel flabellato-spathulata, 7·2–9·0 mm. longa; limbus 3·2–4 mm. longus, 2·3–3·2 mm. latus. *Stamina* 5–6; filamenta linearia, 5–7·5 mm. longa, 0·3–0·5 mm. lata, superne filiformia; thecæ 1 mm. longæ. *Ovarium* 1·4–1·6 mm. longum; stylus 3·5–6 mm. longus, parte communi 2·5–4·2 mm. longa, ramis tribus 1–2 mm. longis; stigmata clavata vel linearia, 0·3–0·5 mm. longa; ovula 3–10 (1–4 pro placenta), pendula, 0·5–0·6 mm. longa, funiculis inferne per 0·3 mm. ad valvas adnatis.

WESTERN AUSTRALIA. S.W. Australia, *Drummond* 5th coll. suppl. 80! (type). Hine's Hill, Oct. 1923, *Koch* 2819!

Koch 2819 has slightly larger flowers than the type, but agrees in all essential characters. *F. brachyphylla* differs from *F. punctata* in habit, in leaf-characters, and in the possession of somewhat larger flowers.

5. F. DECURRENS Summerhayes, sp. n.—*F. pauciflora* Benth. Fl. Austral. i, 151 (1863), partim, non DC.

Caules adscendentes vel erecti, ad 28 cm. longi, superne multiramosi, fasciculis axillaribus foliorum, ut rami minute pubescentes, demum glabri, internodiis ad 2·1 cm. longis. *Folia* linearia, leviter curvata, obtusa vel subacuta, 3–6 mm. longa, 0·6–0·7 mm. lata, e basi breviter decurrentia cauli adpressa, supra canaliculata, minute sparseque scabrido-pilosula, glandulis valde punctata, subtus densissime pubescentia; vagina ciliata, extra glabra. *Flores* solitarii vel in dichasiis 3–5-floris. *Bracteolæ* petiolatæ, 3·3–5 mm. longæ, 0·6–0·7 mm. latæ; petiolus applanatus, 0·4 mm. longus. *Calyx* 5–5·3 mm. longus, 1·2 mm. diametro, 5-costatus, extra præter partes intercostales superne minute papillato-pilosulas glaber, intus glaber; lobi ovati (explanati), acuti, 0·7–1 mm. longi, basi 0·8–1 mm. lati, conduplicati. *Petala* 5, anguste elliptico-spathulata, 8·7–9·5 mm. longa; limbus 3 mm. longus, 0·8–1·1 mm. latus. *Stamina* 6; filamenta linearia, 6·2–8·5 mm. longa, 0·4 mm. lata; thecæ 1·1–1·4 mm. longæ. *Ovarium* 2·3–2·4 mm. longum, trimerum; stylus 5·5 mm. longus, parte communi 3·8 mm. longa, ramis tribus 1·7 mm. longis; stigmata clavato-capitata, 0·3 mm. longa; ovula 8–9 (2–3 pro placenta), 0·4 mm. longa.

WESTERN AUSTRALIA. S.W. Australia, nr. Cape Riche, 1850, *Drummond* 5th coll. suppl. 78! (type).

6. F. CINEREA A. DC. in Linnæa, xxv, 575 (1852).—*F. Maidenii* Ostenf. in Dansk Bot. Arkiv, ii, 52 (1918). *F. fruticulosa* Osborn in Trans. Roy. Soc. S. Austral. xlvi, 562 (1922), non DC.

Caules multiramosi, ramis fere simplicibus virgatis, ad 19 cm. longi, juventute dense breviter pubescentes, demum glabri, internodiis ad 1·5 cm. longis sed plerumque multo brevioribus foliis ergo imbricatis. *Folia* linearia vel oblonga, obtusa vel acuta, interdum apiculata, 1·2–4·2 (rarius ad 5) mm. longa, 0·5–1 mm. lata, basi sæpius paulum deorsum producta nunc ad 1–1·5 mm., nunc cordata tantum, supra puberula vel fere glabra, glandulis valde punctata, crusta alba interrupte tecta, subtus dense pubescentia; vagina ciliata, extra pubescens. *Flores* solitarii vel in dichasiis irregularibus multiramosis. *Bracteolæ* foliis conformes, sessiles, 1–3·2 mm. longæ, 0·5–1 mm. latæ, inferne alis angustis ciliatis instructæ. *Calyx* 3·7–6 mm. longus, 1–1·8 mm. diam., 5-costatus, extra secus medium costarum interdum glaber, ceterum dense pubescens, intus basi longe adpresseque pilosus; lobi lanceolati, oblongi vel ovati, obtusi vel acuti, cuspidati, 0·5–1·4 mm. longi, basi 0·6–1 mm. lati, cuspide solida ad 0·3 mm. longa, introrsum conduplicati vel concavi tantum. *Petala* 5 flabellato-, obovato- vel cuneato-spathulata, 4·5–8 mm. longa; limbus 2·2-4 mm. longus, 1·4–3 mm. latus, superne subtruncatus. *Stamina* 6; filamenta linearia, 4·3–6·7 mm. longa, 0·2–0·6 mm. lata, 1 mm. supra basin quam alibi latiora, abhinc sursum sensim attenuata, apicem versus subulata; thecæ 0·6–1·2 mm. longæ. *Ovarium* 1·2–2·8 mm. longum, 2–3-merum; stylus 3·7–5 mm. longus, parte communi 1·3–4·6 mm. longa, ramis duobus vel tribus 0·8–2 mm. longis; stigmata linearia vel lineari-clavata, 0·3–0·8 mm. longa; ovula 4–18 (1–6 pro placenta), 0·2–0·4 mm. longa. *Capsula* 2·5 mm. longa; semina 3–5, ovoidea usque oblongo–fusiformia, 0·7–1 mm. longa, reticulata, brevissime papillosa vel breviter molliter pubescentia.

WESTERN AUSTRALIA. Sharks Bay, 1829, *Gaudichaud*! (type in Herb. Delessert). Nannine, Sept. 1903, *Fitzgerald*! Cue, Oct. 1909, *Maiden*! Kumunoppin, *Fraser*! Lake Lefroy, Widgimooltha, in bare clayey depressions, Sept. 1922, *Gardner* 1925! (Herb. Berol.).

SOUTH AUSTRALIA. Ooldea, soak by salt-pan, July 1922, *Osborn*!

7. F. PUNCTATA Turcz. in Bull. Soc. Nat. Mosc. xxvii, II, 367 (1854); Benth. Fl. Austral. i, 153 (1863); Diels & Pritzel in Engl. Bot. Jahrb. xxxv, 390 (1904); Ostenf. in Dansk Bot. Arkiv, ii, 53 (1918).

Caules superne multiramosi, ad 32 cm. longi, caules ramique juventute minute pubescentes, demum glabri, internodiis brevissimis ad 6 mm. longis. *Folia* linearia vel anguste oblonga, e basi deorsum per 0·5–2 mm. producta cauli adpressa e basi utroque angustata, apice acuta vel obtusa, in toto 1·8–3·7 mm. longa, 0·5–1 mm. lata, supra glabra vel minute pubescentia, glandulis valde punctata, subtus dense pubescentia; vagina brevissima, interdum vix obvia, ciliata. *Flores* solitarii vel in dichasiis brevibus 3–5-floris. *Bracteolæ* sessiles vel brevissime petiolatæ, lineares, basi deorsum haud producta, ceterum foliis similes, 1·5–3 mm. longæ, 0·4–0·6 mm. latæ; petiolus 0·2–0·3 mm. longus, vaginæ bractearum non adnatus. *Calyx* 3·8–4·6 mm. longus, 0·8–1·2 mm. diametro, 5–6-costatus, extra fere glaber vel ±breviter pubescens, intus glaberrimus; lobi triangulari-lanceolati usque oblongo-ovati, acuti, 0·3–0·8 mm. longi, basi 0·3–0·8 mm. lati, conduplicati. *Petala* 5, anguste obovato- vel cuneato-spathulata, 5·3–6·6 (7–7·7: *Mrs. Heal*) mm. longa; limbus 2·6–3·4 mm. longus, 1·1–1·5 (1·7: *Mrs. Heal*) mm. latus. *Stamina* 5–6; filamenta linearia, 3·2–6·3 mm. longa, 0·1–0·4 mm. lata, superne filiformia; thecæ 0·7–0·8 (1: *Mrs. Heal*) mm. longæ. *Ovarium* 1·5–2 mm. longum, 2–3-merum; stylus 3·5–5 mm. longus, parte communi 1·7–3·2 mm. longa, ramis duobus vel tribus 1·8–3 mm. longis (in specimine a Mrs. Heal ad Cummening lecto stylo interdum fere usque ad basin diviso); stigmata clavata usque filiformia, 0·1–1 mm. longa; ovula 2–7 (1–3 pro placenta), funiculis 0·2–0·3 mm. supra basin valvæ affixis, 0·5–0·8 mm. longa. *Capsula* deest; semina obovato-oblonga, apiculata, 0·9–1·3 mm. longa, minute pubescentia.

WESTERN AUSTRALIA. "Swan River," *Drummond* 3rd coll. (1845) 137!

(type). No label, *ex Herb. West. Austral.*! Cummening, 1890, *Mrs. Heal*! (*Diels* 7839, Herb. Berol.). Wagin Lake, *Miss Cronin*! (*Diels* 7834, Herb. Berol.).

The stigmas may have been broken at the apex in some cases, but the average of the figures mentioned above represents approximately the normal length.

A specimen collected by Jutson at Comet Vale, near Goongarrie, agrees with *F. punctata* in foliage and general floral measurements, but is obviously abnormal, since in the only complete flower found there were 6 petals, 8 stamens, and the ovary was tetramerous, there being 10–11 ovules to each placenta. Other flowers, imperfect otherwise, had about 3–4 ovules per placenta.

§ 2. LANCEOLATÆ.

8. F. IRREGULARIS Summerhayes, sp. n.—*F. lævis* F. Müller & Tate in Trans. Roy. Soc. S. Austral. xvi, 343 (1896), partim, non L.

Caules ad 26 cm. longi, multiramosi, sparse pilosi vel glabri, demum glabri, internodiis brevibus ad 1·5 cm. longis. *Folia* obtusa vel acuta, apiculata, 2·7–6 mm. longa, 0·7–1·5 mm. lata, supra glabra vel sparse obtuseque scabrido-puberula, glandulis punctata, subtus dense papillato-pilosula, costa prominente glabra excepta; vagina ciliis interdum ramosis, extra glabra. *Flores* in dichasiis elongatis sympodialibus ramulis alteris unifariam dispositis erectis ±abbreviatis sæpe efloriferis interdum abortivis. *Bracteolæ* foliis similes sed petiolatæ, 2·3–5·2 mm. longæ, 0·6–1·0 mm. latæ; petiolus 0·2–0·4 mm. longus, basi vaginæ bractearum adnatus. *Calyx* 5–7 mm. longus, 1·3–2·2 mm. diametro, 5–6-costatus, extra costis glabris, inter costas basi setuloso-pilosus vel puberulus, intus glaber; lobi lanceolati vel lanceolato-ovati, acuti, cuspidati, 1–1·5 mm. longi, basi 1–1·2 mm. lati, cuspide solida brevissima, introrsum concavi. *Petala* 5, obovato- vel flabellato-spathulata, 7·2–10 mm. longa; limbus 3·3–4·5 mm. longus, 2–4·3 mm. latus. *Stamina* 6–7; filamenta linearia, 5·5–8·5 mm. longa, 0·4–0·6 mm. lata, apice subulata, basi angustata; thecæ 1–1·2 mm. longæ. *Ovarium* 2–2·7 mm. longum, trigonum; stylus 4·5–5·8 mm. longus, parte communi 3·7–4·3 mm. longa, ramis tribus 1–2 mm. longis; stigmata linearia, leviter curvata, 0·4–1·2 mm. longa; ovula 24–33 (8–11 pro placenta), parietalia, 0·3 mm. longa.

WESTERN AUSTRALIA. Near Hunt's Well, Hampton Plains, in clayey sand of creek-bed, Nov. 1891, *Helms*! (type). Southern Cross, *Eaton*! (*Diels* 7823, Herb. Berol.).

Very much resembling *F. desertorum* Summerhayes, but easily distinguished by the numerous ovules and different habit.

9. F. DESERTORUM Summerhayes, sp. n.—*F. pauciflora* S. Moore in Journ. Linn. Soc., Bot. xxxiv, 178 (1899), non DC. *F. interioris* Ostenf. in Dansk Bot. Arkiv, ii, 53 (1918), partim.

Caules multiramosi, ad 28 cm. longi, juventute dense patentim vel retrorse pubescentes, demum glabri, internodiis ad 2·2 mm. longis. *Folia* acuta vel apiculata, 2–5·5 mm. longa, 0·5–1 mm. lata, supra glabra vel sparse curvato- vel patentim pilosa, subtus dense albido-pilosula, costa subtus prominente paginæ superiori similiter induta; petiolus ad 0·5 mm. longus, sæpius satis brevior; vagina extra glabra vel pubescens. *Flores* in dichasiis sæpe laxis pluries furcatis ramis divaricatis vel patentibus. *Bracteolæ* foliis conformes, sessiles vel breviter (ad 0·3 mm.) petiolatæ, 2–5·7 mm. longæ, 0·5–1·5 mm. latæ. *Calyx* 6·3–7·5 mm. longus, 1–1·8 mm. diametro, extra 5- (rarius 4-) costatus, costis retrorse setuloso-pilosis vel superne fere glabris, inter costas puberulus, intus glaber vel ±puberulus; lobi lineari- vel oblongo-lanceolati, acuti vel acuminati, cuspidati, 1–1·8 mm. longi, basi 0·5–1 mm. lati, cuspide solida pubescente ad 0·7 mm. longa, introrsum conduplicati vel concavi tantum. *Petala* 5, pallide purpurea vel rosea, obovato-, cuneato-, vel flabellato-spathulata, 8·2–10·7 (6·8–8: *Diels* 5255) mm. longa; limbus 3·5–4·8 mm. longus, 2–3 (1·5–1·8: *Diels* 5255) mm. latus. *Stamina* 6, rarius 4; filamenta anguste linearia, 5·5–11·8 mm. longa, 0·1–0·3 mm. lata, superne subulata; thecæ 1–1·6 mm. longæ. *Ovarium* 1·3–1·8 mm. longum, trimerum; stylus 5–8 mm. longus, parte communi 3·7–6 mm. longa, ramis tribus 1–2·3 mm. longis: stigmata clavata vel linearia 0·2–0·7 mm. longa; ovula basalia, 3, vel rarissime 5, et tunc funiculis connatis vel divisis, 0·5–1 mm. longa. *Capsula* 2·2–2·5 mm. longa; semina 1–3, circumferencia ovato-oblonga, 1·4–1·6 mm. longa, lævia.

WESTERN AUSTRALIA. No. 8 Pumping Station, Dedari, 420 m., Sept. 1903, *G. H. Thiselton-Dyer* 6! (type). Gibraltar, Sept. 1895, *S. Moore*! Bullabulling, open *Eucalyptus* woodland on hard loam, 450 m., Oct. 1901, *Diels* 5202! (Herb. Berol.). Dundas, on loam in open salty places, 300 m., Nov. 1901, *Diels* 5255! (Herb. Berol.). Coolgardie District, *Webster*! (Herb. Mus. Brit.).

In one case five ovules were found in a trimerous ovary, the funicles in two cases being divided about halfway up and bearing two ovules. In another flower on the same plant there were two ovules on one placenta, one on another, and none on the third. This suggests that in § Lanceolatæ the basigonial condition has only just been reached, and is not yet fixed in any one species.

10. F. INTERIORIS Ostenfeld in Dansk Bot. Arkiv, ii, 53 (1918), partim.

Caules modice ramosi, ad 25 cm. longi, primum dense et sæpe retrorse pubescentes, deinde glabri, internodiis ad 2 cm. longis. *Folia* acuta vel obtusa, 1·5–5 mm. longa, 0·5–1·2 (rarius ad 2) mm. lata, supra dense retrorse pubescentia, subtus costa prominente paginæ superiori similiter induta excepta albido-puberula, sæpe glandulis punctata; petiolus ad 0·5 mm. longus, sæpe deficiens; vagina extra ±pubescens. *Flores* in dichasiis foliosis pluries furcatis. *Bracteolæ* foliis similes, plerumque sessiles, 2–4 (4·3–6·2: *Webster* b.) mm. longæ, 0·5–1·5 mm. latæ. *Calyx* 5·5–7·5 mm. longus, 1–1·7 mm. diametro, 5-costatus, extra partibus intercostalibus superne puberulis exceptis dense pubescens, intus glaber vel minute puberulus; lobi lanceolati vel oblongo-lanceolati, acuti vel subacuti, cuspidati, 0·8–1·5 mm. longi, basi 0·5–1 mm.

lati, cuspide solida ad 0·5 mm. longa, introrsum concavi vel conduplicati. *Petala* 5–6, obovato-spathulata, 7·5–11 mm. longa; limbus 4–4·8 mm. longus, 2·5–3·7 mm. latus. *Stamina* 6; filamenta anguste linearia, 6·5–10·5 mm. longa, 0·1–0·4 mm. lata; thecæ 1–1·4 mm. longæ. *Ovarium* 1·5–2·3 mm. longum; stylus 4·6–9 mm longus, parte communi 3–8 mm longa, ramis tribus 1–2 mm. longis; stigmata clavata vel linearia, 0·2–0·7 mm. longa; ovula 3, rarius 4, basalia, 0·4–0·7 mm. longa. *Capsula* 2·5–3·2 mm. longa, 0·7 mm. diametro; semen 1, ovoideum vel conico-pyriforme, 1·7–2 mm. longum, læve.

WESTERN AUSTRALIA. Kalgoorlie, arid places, Oct. 1914, *Ostenfeld* 1110! (type in Herb. Copenhagen). Broad Arrow, Sept. 1898, *Fitzgerald*! Comet Vale, Dec. 1916, *Jutson*! Coolgardie District, *Webster*! (Herb. Mus. Brit.). No label, *ex Nat. Herb. N.S.W.*! (probably from Western Australia).

In one case 4 ovules were found. See note under *F. desertorum*.

Var. PARVIFLORA Summerhayes, var. n. differt a typo speciei calyce petalisque brevioribus, staminibus 4, ovario di- rarius trimero.—*F. tetrapetala* F. Muell & Tate in Trans. Roy. Soc. S. Austral. xvi, 343 (1896), partim, non Labill.

Calyx 3·8–5 mm. longus, 4–5-costatus. *Petala* 4–5, 6·6–7·3 mm. longa, 1·6–1·8 mm. lata. *Stamina* 4, 3–7 mm. longa; thecæ 1 mm. longæ. *Ovarium* 2–3-merum; ovula 2–3, basalia, 0·5–0·6 mm. longa.

WESTERN AUSTRALIA. Southern Cross, margin of salt-lake, Nov. 1891, *Helms*! (type).

[SOUTH AUSTRALIA. Murat Bay, Nov. 1915, *Black*!]

The second specimen cited was found with a specimen of *F. sessilis* Summerhayes, sent from the National Herbarium of Victoria under the above label. Since duplicates of Helm's specimens are probably at Melbourne, it seems likely that a piece of the type collection has become mixed, especially as § Lanceolatæ is otherwise restricted to the deserts of South-Central Western Australia. The locality in the second specimen is therefore probably incorrect, as J. M. Black makes no mention of any other species but *F. sessilis* when dealing with his Murat Bay gatherings.

§ 3. CORDATÆ.

11. F. CORDATA J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 177, t. xvii, figs. 15–18 (1918); Fl. S. Austral. 393, t. 36, figs. 15–18 (1926).—*F. pauciflora* Benth. Fl. Austral. i, 151 (1863), partim, non DC. *F. lævis* F. Muell. & Tate in Trans. Roy. Soc. S. Austral. xiii, 98 (1890), partim, non L.

Caules modice vel multiramosi, ad 18 cm. longi; rami juventute ±dense curvato- vel rarius semiuncinato-pilosi, demum glabri, internodiis ad 2·5 cm. longis. *Folia* rarius brevissime petiolata, linearia vel lineari-lanceolata usque ovata, interdum curvata, acuta, basi rotundata vel ±cordata, 1·7–10 mm. longa, 0·6–2·6 mm. lata, supra glabra, glauca, glandulis valde punctata, subtus dense farinaceo-puberula; petiolus ad 0·4 mm. longus; vagina ciliata, extra glabra. *Flores* solitarii vel in dichasiis pluries furcatis. *Bracteolæ* foliis conformes, 1·7–8·3 mm. longæ, 1–2·5 mm. latæ, petiolo rarius ad 0·4 mm. longo. *Calyx* superne tubulosus basi dilatatus, 5·5–9 (3·7 : *Basedow* 27) mm. longus, 1–2·2 mm. diametro, extra superne fere glaber, basi sæpius dense setuloso-pilosus, intus glaber vel pubescens ; lobi triangulari-ovati, breviter cuspidati, 0·7–2 mm. longi, basi 1–1·5 (0·5–0·7 : *Mueller*) mm. lati, cuspide solida ad 0·3 mm. longa, conduplicati. *Petala* 5–6, obovato-spathulata, 8–13·8 mm. longa ; limbus 2·2–4·7 mm. latus. *Stamina* 4–6 ; filamenta linearia, 5·3–10 mm. longa, 0·3–0·6 mm. lata, superne subulata ; thecæ 1–1·3 mm. longæ. *Ovarium* 1·8–2·5 mm. longum, 2–3-merum ; stylus 6–6·8 mm. longus, parte communi 3·7–4·7 mm. longa, ramis duobus vel tribus 2–2·3 mm. longis ; stigmata lineari-clavata vel clavata, 0·2–0·5 mm. longa ; ovula 2–4 (1–2 pro placenta), 0·5–0·6 mm. longa, funiculis superne refractis ovula ergo pendula. *Capsula* (unica visa : *Basedow* 27) 2·8 mm. longa, valvis 3 ; semina 3, ovoideo-ellipsoidea, 1–1·2 mm. longa, dense pubescentia, funiculis in fructu incrassatis applanatis.

SOUTH AUSTRALIA. Between Everard Range and Wantapella Swamp, 18/8/14, *S. A. White* ! (type). N.W. South Australia, 1903. *Basedow* 27 ! (Herb. Berol.)

CENTRAL AUSTRALIA. West of L. Amadeus, 1889, *Tietkens* ! (Herb. Adel.).

WESTERN AUSTRALIA. Hann Breakaways, Wall Creek, between Wilkinson and Warburton Ranges, on loamy flats, 1916, *Clarke* 165 ! Sturt's Creek, 1856, *F. Mueller* !

A typical Eremian species restricted to central Australia. This and *F. speciosa* may be conspecific, but there is not yet sufficient material available to justify the union.

12. F. SPECIOSA Summerhayes, sp. n.—*F. pauciflora* Ewart & Davies, Fl. Northern Territory, 195 (1917), partim, non DC.

Caules ad 24 cm. longi, pauciramosi, sparse vel dense patentim setuloso-pilosi, demum glabri, internodiis ad 2·3 cm. longis. *Folia* lineari- vel ovato-lanceolata, acuta vel obtusa, basi ±cordata vel rotundata tantum, 2·2–7·2 mm. longa, 1–4·8 mm. lata, supra glabra vel præsertim versus margines breviter scabrido-pilosa, valde punctata, subtus longe et densiuscule patentim setuloso-pilosa ; vagina communis foliorum vix evoluta, ciliata, extra pilosa. *Dichasia* pluries furcata. *Bracteæ et bracteolæ* foliis conformes, 2–5·7 mm. longæ, 1–2·8 mm. latæ ; earum vagina communis tubum brevem (circiter 2 mm. longum) formans, basin calycis amplectens et eædem adnata. *Calyx* tubulosus, basi dilatatus, 7·3–9·3 mm. longus, 1·3–1·7 mm. diametro, extra præsertim inferne longe patentim setuloso-pilosus, intus minute papillato-pilosulus ; lobi lanceolati vel oblongo-lanceolati, acuti, 1–2 mm. longi, basi 0·8–1·3 mm. lati, conduplicati. *Petala* 5, flabellato- vel anguste obovato-spathulata, 12–16 mm. longa ; limbus 5·8–8·2 mm. longus, 3·3–5·0 mm. latus. *Stamina* 6 ; filamenta linearia, 7·8–12 mm. longa, 0·3–0·5 mm. lata ; thecæ 1·2–1·8 mm.

longæ. *Ovarium* 2·2–2·8 mm. longum, trimerum ; stylus 7·8–9·2 mm. longus ; parte communi 4–6·2 mm. longa, ramis tribus 1·6–5·0 mm. longis ; stigmata lineari-clavata vel clavato-capitata, 0·2–0·8 mm. longa ; ovula 5–6 (2 pro placenta) 0·5–0·7 mm. longa, funiculis longis superne refractis 0·3–0·8 supra basin ovarii insertis. *Capsula* 4·5 mm. longa ; semen 1, ellipsoideo-ovoideum, 1·6 mm. longum, papillosum vel scaberulum.

CENTRAL AUSTRALIA. " Central Australia," 1873, *Gosse* 82 ! (type). 60 miles N.E. of Camp 2 (The Lander), 7/6/1911, *G. F. Hill* !

Closely allied to *F. cordata* J. M. Black, from which it differs chiefly in the sunken calyx, and to *F. ambita* Ostenfeld, which has smaller flowers and differently shaped leaves.

13. F. AMBITA Ostenf. in Dansk Bot. Arkiv, ii, 24, 51 (1918).

Caules plerumque prostrati, repentes et rarius e nodis radicantes, irregulariter ramosi, ad 35 cm. longi ; rami primum breviter pubescentes vel jam fere glabri, deinde glabri, internodiis ad 2·6 cm. longis. *Folia* linearia, oblongo-linearia vel lanceolata, acuta vel obtusa, 2·3–6·5 mm. longa, 0·5–2 mm. lata, supra glabra vel rarius sparse scabrido-pilosula, glandulis punctata, subtus dense albido-puberula costa glabra excepta ; vagina ciliata, extra glabra vel pubescens. *Flores* solitarii vel in dichasiis pluries furcatis. *Bracteæ* et *bracteolæ* foliis similes, sessiles, lineari-lanceolatæ usque anguste triangulares, acutæ, 1·8–6 mm. longæ, 0·5–1·5 mm. latæ ; earum vagina communis tubum 0·8–1·5 mm. longum formans, basin calycis amplectens et eædem inferne adnata. *Calyx* in toto 4·5–6 mm. longus, 1–1·5 mm. diametro, extra superne costis glabris inter costas puberulus, juxta vaginam communem bractearum et bracteolarum setuloso-pubescens, intus glaber vel pubescens ; lobi lanceolati, acuti, cuspidati, 0·7–1·5 mm. longi, basi 0·5–1 mm. lati, cuspide solida 0·2–0·3 mm. longa, introrsum concavi vel conduplicati. *Petala* 5, obovato- vel flabellato-spathulata, 6·5–9·5 mm. longa ; limbus 2·5–3·5 mm. longus, 1·5–2·5 mm. latus. *Stamina* 5–7 (sæpius 6) ; filamenta linearia vel rarius lineari-filiformia, 4·5–8·8 mm. longa, 0·1–0·4 mm. lata ; thecæ 0·6–1 mm. longæ. *Ovarium* 1·7–3 mm. longum, trimerum ; stylus 3·5–5·7 mm. longus, parte communi 2·4–4 mm. longa, ramis tribus 1·2–2·4 mm. longis ; stigmata lineari-clavata vel linearia, 0·3–0·8 mm. longa ; ovula 4–6 (1–2 pro placenta), 0·4–0·6 mm. longa, funiculis superne refractis nec elongatis sed valvis adnatis. *Capsula* et semina non visa. (Pl. 16, *f*.)

WESTERN AUSTRALIA. Port Hedland, in depressions between dunes, Nov. 1914, *Ostenfeld* 1138 ! (type in Herb. Copenh.), April 1904, *Fitzgerald* 74 ! (Herb. W.A.). Cossack, salty places on loam, Apr. 1901, *Diels* 2750 ! (Herb. Berol.). Point Sampson, Cossack, Nov. 1914, *Ostenfeld* 1137 ! (Herb. Copenhagen). Dampier Archipelago, 1818, *Cunningham* 132 ! [Dirk Hartog's I., 1818, *Cunningham* 219 !].

An examination of Cunningham's collector's notes shows that he made only two collections of Frankenias, namely at the two places and with the two numbers cited above. As the Dirk Hartog's I. locality is so far from the others, it seems likely that the labels have been mixed, and that the last-cited specimen was really collected in Dampier Archipelago. With the exception of the specimen cited above, the material collected at Dirk Hartog's I. belongs to *F. pauciflora* DC.

§ 4. PARVULÆ.

14. F. PARVULA Turcz. in Bull. Soc. Nat. Mosc. xxvii, II. 368 (1854) ; Benth. Fl. Austral. i, 152 (1863) ; Ostenfeld in Dansk Bot. Arkiv, ii, 53 (1918).

Caules ad 10 cm. longi ; rami procumbentes vel adscendentes, multiramosi, glabri vel pilis paucis patentibus præditi, vaginis foliorum delapsorum tecti, internodiis rarissime ad 7 mm. longis. *Folia* obtusiuscula, leviter curvata, 1·8–2·8 mm. longa, 0·7–1 mm. lata, subcarnosa, marginibus revolutis ita ut folia sulcata videantur, compresso-teretia vel subcymbiformia, supra leviter longitudinaliter canaliculata, juventute sparse pilosa, deinde glabra, subtus dense pubescentia ; petiolus 0·2–0·5 mm. longus ; vagina setuloso-ciliata, ciliis 0·7 mm. longis, extra glabra, inter petiolos 0·5–0·8 mm. longa. *Dichasia* pluries furcata. *Bracteolæ* foliis similes sed petiolo longiore instructæ, 2 mm. longæ, 0·7 mm. latæ ; petiolus 1–1·2 mm. longus. *Calyx* ovoideo-cylindricus, 4 mm. longus, 1·8 mm. diametro, 5-costatus, extra superne pilis setuliformibus patentibus et pilis brevibus adpressis obtectus, inferne glaber, intus glaber vel sparsissime pilosulus ; lobi lanceolati, acutiusculi, cuspidati, 1–1·2 mm. longi, basi 0·7–1 mm. lati, cuspide solida ad 0·3 mm. longa, conduplicati. *Petala* 5, late flabellato-spathulata, 5·3–6 mm. longa ; limbus 2·5–3 mm. longus, 2–2·8 mm. latus. *Stamina* 6–7 ; filamenta linearia, 3·3–4 mm. longa, 0·3–0·4 mm. lata ; thecæ 0·8–0·9 mm. longæ. *Ovarium* 1·5 mm. longum, trigonum ; stylus 3·7 mm. longus, parte communi 2 mm. longa, ramis tribus 1·5–1·7 mm. longis ; stigmata clavato-capitata, 0·2 mm. longa ; ovula 11–15 (3–5 pro placenta), 0·3–0·4 mm. longa. *Capsula* non visa. (Pl. 16, *b*.)

WESTERN AUSTRALIA. S.W. Australia, 1850, *Drummond* 5th coll. suppl. 81 ! (type).

A very distinct species which has apparently not been gathered since Drummond discovered it.

§ 5. PAUCIFLORÆ.

15. F. CONFUSA Summerhayes, sp. n.—*F. pauciflora* DC., var. *serpyllifolia* Benth. Fl. Austral. i, 152 (1863), partim. *F. serpyllifolia* W. J. Bray in Engl. Jahrb. xxiv, 404 (1898), in obs ; Ostenfeld in Dansk Bot. Arkiv, ii, 51 (1918) ; non Lindl.

Fruticulus vel ? herba annua basi lignosa ; caules ramosi, ad 25 cm. longi, dense breviterque pubescentes, demum glabri, internodiis ad 2·5 cm. longis. ***Folia*** superiora oblonga vel linearia, basi fere cordata, inferiora oblonga vel oblongo-elliptica, basi cuneata vel rotundata, omnia acuta vel rotundata, 1·8–8 mm. longa, 0·8–3 mm. lata, marginibus revolutis, supra sparse et minute pubescentia vel fere glabra, subtus minute papillato-puberula vel farinosa, costa subtus prominente; petiolus 0·2–1 mm. longus; vagina extra pubescens. *Dichasia* pluries vel multoties furcata, elongata, interdum apice in monochasia falsa transientia, ad 12 cm. longa. *Bracteolæ* foliis conformes, 2·3–3·8 mm. longæ, 0·7–1·2 mm. latæ. *Calyx* tubulosus, 5·5–6·5 mm. longus, 1·2–1·8 mm. diametro, extra 4–5-costatus, costis dense breviterque pubescentibus, inter costas puberulus, intus glaber; lobi late ovati vel oblongo-lanceolati, acuti, 1–1·8 mm. longi, basi 0·8–1·3 mm. lati, cuspide solida 0·1–0·3 mm. longa, conduplicati. *Petala* 4–5, subflabellato- vel obovato-spathulata, 8–9 mm. longa; limbus 2–3·7 mm. latus, in unguem sensim attenuatus. *Stamina* 6; filamenta linearia, 5·5–7·5 mm. longa, 0·3–0·5 mm. lata, superne filiformia; thecæ 1–1·5 mm. longæ. *Ovarium* 1·8–3 mm. longum, 3–4-merum; stylus 4–8·2 mm. longus, parte communi 3–5·2 mm. longa, ramis tribus 1–2·4 mm. longis; stigmata linearia, 0·5–1 mm. longa; ovula 15–20 (5–8 pro placenta), 0·3 mm. longa. *Capsula* 3·7 mm. longa; semina juvenilia 17, dense et minute pubescentia. (Pl. 16, *l*.)

WESTERN AUSTRALIA. Without definite locality, comm., *F. Mueller*! (type in Herb. Berol.). Murchison River, *Oldfield*!

16. F. PAUCIFLORA DC. Prodr. i, 350 (1824); Benth. Fl. Austral. i, 151 (1863), partim; Ostenfeld in Dansk Bot. Arkiv, ii, 50 (1918). (Map, text-fig. 3.)

Caules modice ramosi, ad 30 cm. longi; rami juventute dense pubescentes, demum glabri, cortice tandem in tænias fisso et deciduo, internodiis ad 3·3 cm. longis. *Folia* linearia, subacuta usque rotundata, 2–7 mm. longa, 0·6–1·2 mm. lata, marginibus crassis leviter revolutis, folia itaque subtus anguste bisulcata, supra glabra vel rarius minute scabrido-pilosa, glandulis leviter punctata, subtus in sulcis dense albido-pubescentia, costa prominente glabra vel ± breviter pilosa; petiolus applanatus, 0·3–1·2 mm. longus; vagina extra glabra vel pubescens. *Flores* in dichasiis sæpius brevibus densis nonnunquam laxioribus multiramosis. *Bracteolæ* foliis similes, 2·2–5·5 mm. longæ, 0·5–1 mm. latæ; petiolus 0·3–1·2 mm. longus. *Calyx* tubulosus, 6·5–8 (rarius ad 8·8) mm. longus, 1·5–2·2 (rarius ad 2·6) mm. diametro, 5–6- (rarius 4-) costatus, extra glaber vel rarius costis ±pubescentibus, inter costas minute papillatus, intus glaber, sæpe inter costas linea lata pilorum instructus; lobi lanceolati vel ovato-lanceolati, acuti, subulato-cuspidati, 1–2·5 mm. longi, basi 0·7–1·5 (rarissime ad 1·7) mm. lati, cuspide solida 0·2–0·6 mm. longa, conduplicati. *Petala* 5–6, raro 4, obovato- vel rarius flabellato-spathulata, 7·3–12 mm. longa, vulgo ultra 9 mm. longitudine; limbus 3·5–6·5 mm. longus, 2–3·3 mm. latus. *Stamina* 5–7, sæpius 6; filamenta linearia, 6–9·5 (5–6·3: *Milne*; 5·5–7: *Gilbert* 31) mm. longa, 2–3 mm. supra basin 0·4–0·8 mm. lata, utroque angustata, versus apicem subulata; thecæ 1–2 mm. longæ. *Ovarium* 1·7–3 mm.

longum, trimerum; stylus 5·5–8·8 mm. longus, parte communi 3·5–6·3 mm. longa, ramis tribus (rarius 4) 1·7–3·5 mm. longis; stigmata linearia vel filiformia, 0·7–1·5 mm. longa; ovula 17–43 (6–15 pro placenta) 0·2–0·6 mm. longa. *Capsula* 3·5–5 mm. longa; semina 8–47, ovoideo-fusiformia vel ellipsoidea, 0·8–1·2 mm. longa, lævia vel raro papillosa.

Western Australia. "Nouvelle Hollande, Côte occidentale, 1901" (Shark's Bay) *Baudin* ! (type in Herb. Mus. Paris). Shark's Bay, *Milne* ! Dirk Hartog's Island, 1818, *Cunningham* 219 ! Rocky islet S.E. side of Montebello I., Sept. 1840, *Bynoe* ! Minilya, Nov. 1897, *J. G. Brockman* ! (Herb. Dept. Agric. W.A.). Abrolhos Is., West Wallaby I., May 1840, *Bynoe* ! South I., 1842, *Gilbert* 31 ! (Herb. Mus. Brit). "Swan River," 1843, *Drummond* 2nd coll. 105 ! Without no. !

Typical *F. pauciflora* is characterized by its relatively short blunt leaves, usually small dense dichasia, and large number of ovules on each placenta.

Var. β. longifolia Summerhayes, var. n. differt a typo foliis longioribus, dichasiis sæpius laxis longisque, ovulis sæpius paucioribus.—*F. pauciflora* Graham in Curt. Bot. Mag. t. 2896 (1829); Ostenfeld in Dansk Bot. Arkiv, ii, 50 (1918), partim; Osborn in Trans. Roy. Soc. S. Austral. xlvi, 205 (1922), partim; xlvii, 116 (1923). *F. fruticulosa* Lehm. Pl. Preiss. i, 249 (1845), non DC. *F. lævis* F. Muell Ann. Rep Govern. Bot. Vict. 1862–3, 11 (1863), partim, non L.

Folia 3–13 mm. longa, 0·5–1·8 mm. lata. *Flores* iis typo similes. *Ovula* 9–25 (rarius ad 40). (Pl. 16, *k*.)

Western Australia Carnarvon, in depressions of the dunes, Oct. 1914, *Ostenfeld* 1101 ! (Herb. Copenhagen). Loamy salt-pastures, 5 m., Aug. 1901, *Diels* 3722 ! (Herb. Berol.), *J. B. Cleland* ! (Herb. Copenhagen). At mouth of Swan River in dry sand among Restiaceous plants, Jan. 1839, *Preiss* 1283 ! (Herbs. Berol., Copenhagen, and Delessert) "In calcareis prope oppidum Freemantle," *Preiss* 145 (Herb. Delessert). Swan River, salt-marshes, *Fraser* 185 ! Cockburn Sound, Isle Berthollet, on rocks, *Fraser* 97 ! Mandurah, salt-swamp by tidal river, April 1902, *C. Andrews*, 1st coll. 62 ! (type) Cape Naturaliste, *Collie* ! S.W. Australia, *Drummond*, 5th coll. suppl. 77 ! "Swan River," *Drummond* ! *Stoward* 78 !, *R. Brown* 5200 ! (Herb. Mus. Brit.) Hort. Edinburgh, ex Nov. Holl. !, Hort. Berol., Aug. 1834 ! Dec. 1842 ! (Herb. Berol.).

South Australia. Eyre I., Smoky Bay, Nov. 1920, *F. Wood Jones* ! East Franklin I., Jan. 1922, *Osborn* ! (Herb. Adelaide). West Franklin I., Jan. 9, 1922, *Osborn* ! S.W. corner on shore protected by granite from sea, Jan. 12, 1922, *Osborn* ! (Herb. Adelaide). South Pearson I., on travertine and sand, Jan. 1923, *Osborn* ! Greenly I., Nov. 1920, *F. Wood Jones* ! (Herb. Adelaide). Journey in 1859 (? 1860) to the interior of Australia, *Stuart* D ! Flinder's Range, Oct. 1901, *Koch* !

Var. *longifolia* is easily recognized from the type by its much longer and apparently narrower leaves, which are quite glabrous above and often rather strongly glandular punctate.

Var. γ. FRUTICULOSA Summerhayes, var. n. differt a typo floribus minoribus, thecis antherarum brevioribus, ovulis sæpius paucioribus, seminibus sæpius papillosis.—*F. fruticulosa* DC. Prodr. i, 350 (1824). *F. pauciflora* Benth. Fl. Austral. i, 152 (1863), partim ; J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 176 (1918), partim ; Osborn in Trans. Roy. Soc. S. Austral. xlvi, 205 (1922), partim, xlvii, 250, 251 (1923), in obs ; J. M. Black, Fl. S. Austral. 391 (1926), partim ; Black & Cleland in Trans. Roy. Soc. S. Austral. li, 47 (1927), partim.

Folia typo conformia sed plerumque scabrido-pilosa. *Calyx* 5–7 mm. longus. *Petala* 6·5–8·5 mm. longa. *Filamenta* 4–6·5 mm. longa ; thecæ 0·7–1·3 mm. longæ. *Stylus* 3·5–6 mm. longus, ramis 1–2 mm. longis ; stigmata 0·3–1·2 mm. longa ; ovula 9–20, rarius ad 36. *Semina* 4–17, plerumque distincte papillosa. (Pl. **16**, *j*.)

SOUTH AUSTRALIA. "Isle St. Francois," 1810, *Baudin* ! (type in Herb. Mus. Paris, Herb. Berol.). St. Francis I., Feb. 1909, *Verco & Tarr.* ! Franklin Is., Jan. 1922, *Osborn* ! (Herb. Adelaide). Flinders I., cliff-top east of landing, Jan. 10th, 1924, *Osborn* ! (Herb. Adelaide) ; on edge of gypsum lake, W. side, Jan. 7th, 1924, *Osborn* ! (Herb. Adelaide) ; coastal, Jan. 7th, 1924, *Osborn* ! (Herb. Adelaide), Jan. 9th, 1924, *Osborn* ! (Herb. Adelaide). South Pearson I., on limestone, Jan. 6th, 1923, *Osborn* ! ; granite rock above crossing place, wet with spray, Jan. 10th, 1923, *Osborn* ! (Herb. Adelaide). Kangaroo I., Cape de Couedic, Jan. 1907, *R. S. Rogers* ! Reevesby I., Spencer Gulf, Jan. 1907, *Maiden* ! Near Port Pirie, comm. Jan. 1882, *Schomburgk* 98 ! (in part.). Port Wakefield, salt-swamp area, March 1923, *Osborn* ! Port Adelaide, (ex Herb. Sonder) *F. Mueller* ! Jan. 1893, *O. Tepper* 29 ! (Herb. Berol.). Port Noarlunga, in a salt-swamp, Jan. 1905, *J. M. Black* ! Encounter Bay, *Whittaker* !

This exclusively South Australian variety is characterized by its short stamens and by the seeds being frequently papillose.

Var. δ. TRICHOSTICHA Summerhayes, var. n. affinis var. *longifoliæ* sed foliis supra linea media pilorum instructis.

SOUTH AUSTRALIA. Port Pirie, Oct. 1901, *Koch* 590 (type in Herb. Berol.). Locality not given ; probably collected by *Tate* (Herb. Adelaide).

Var. ε. GUNNII Summerhayes, var. n. foliis brevibus supra ±pubescentibus, seminibus lævibus.—*F. pauciflora* Hook. f. Fl. Tasman. i, 40 (1860), excl. syn. ; Rodway, Tasman. Fl. 11 (1903) ; J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 176 (1918), partim ; Black & Cleland in Trans. Roy. Soc. S. Austral. li, 47 (1927), partim.

Folia iis typi similia, sed sæpe latiora. *Calyx* 5·3–7·2 mm. longa. *Petala* 7–11 mm. longa. *Filamenta* 5–8 mm. longa ; thecæ 0·7–1·3 mm. longæ. *Semina* leviter reticulata haud papillosa.

SOUTH AUSTRALIA. South Neptune I., Spencer Gulf, Jan. 1907, *Maiden* ! Lutitt (? Louth) Bay, *Dallachy* ! (Herb. Mus. Brit.). Near Port Pirie, comm. Jan. 1882, *Schomburgk* 98 ! (in part.). Walleroo, Nov. 1880, *Tate* ! (Herb.

Adelaide). Port Adelaide, Dec. 1847, *F. Mueller* ! Adelaide, outer harbour, on waste sandy land, April 1926, *F. A. Rodway* ! Kangaroo I., C. de Couedie, Jan. 1907, *R. S. Rogers* ! Bay of Shoals, Jan. 1883, *Tate* ! (Herb. Adelaide). Dudley Peninsula, salt-lagoon, Nov. 1883, *Tate* ! (Herb. Adelaide). South Australia, without definite locality *Wilhelmi* ! (Herb. Copenhagen).

VICTORIA. Barwon mouth, Dec. 1896, *H. B. Williamson* ! Port Lonsdale, Oct.-Nov. 1912, *Tilden* 801 ! Port Phillip, *Latrobe* ! (Herb. Delessert). No collector (possibly *Latrobe*) ! (Herb. Mus. Brit.). Melbourne, Feb. 1853. *Adamson* 38 ! Port Albert, April 1853, *F. Mueller* ! Without definite locality (ex Herb. H. F. Hance 7127) *F. Mueller* ! (Herb. Mus. Brit.).

TASMANIA. Goose Island, Bass Strait, very abundant, Nov. 1843, *Lady Franklin* in Herb. Gunn 1029 ! (type). Flinders I., comm. *L. Rodway* !

Var. *Gunnii* is, as a rule, a more hairy plant than any of the other varieties of *F. pauciflora*, while the number of floral parts seems more variable, the stamens, for instance, varying from 3–8, although the usual number is 6.

Two specimens collected at Comet Vale, near Goongarrie, in Western Australia, by J. T. Jutson in December 1916 agree with *F. pauciflora*, *sensu lato*, but cannot be satisfactorily placed in either of the varieties described above, although agreeing most closely with var. *longifolia*. What is remarkable about them is the fact that they are growing over 250 miles from the coast, whereas *F. pauciflora* is usually restricted to the coast itself or occurs not far inland. I have seen no specimens of *F. pauciflora* nearer to Comet Vale than from Perth, which is distant 350 miles. The specimens resemble *F. laxiflora* in some respects, but have a very different inflorescence. It is probable that these specimens, together with *F. laxiflora* and *F. fecunda*, represent different members of a group which have as yet not diverged much from *F. pauciflora*, although quite isolated in distribution.

17. F. LAXIFLORA Summerhayes, sp. n.

Caules ramosi, ad 20 cm. longi, curvato-pubescentes, demum glabri, facile decorticati, internodiis ad 1·7 cm longis. *Folia* lineari-oblonga vel rarius linearia, rotundata usque acuta, 3–5·7 mm. longa, 0·8–1·3 mm. lata, supra fere glabra vel scabrido-pilosula, valde punctata, subtus albido-puberula ; costa subtus prominens ut pagina superior similiter induta : petiolus 0·5–1 mm. longus ; vagina extra puberula vel pubescens. *Flores* in dichasiis laxis pluries furcatis ramis divaricatis. *Bracteolæ* foliis conformes, 1·5–4·2 mm. longæ, 0·5–1·3 mm. latæ ; petiolus 0·3–1 mm. longus. *Calyx* subfusiformis, 7–12 mm. longus, 2–2·3 mm. diametro, 5-costatus, extra pubescens vel fere glaber, intus glaber, nitens ; lobi lanceolati vel ovati, acuti vel acuminati, conduplicati, 1·2–3 mm. longi, basi 1–2 mm. lati, cuspide solida patente 0·2–1 mm. longa. *Petala* verisimiliter obovato-spathulata, 12–14 mm. longa. *Stamina* 5–6 ; filamenta linearia, 6·5–14 mm. longa, 0·5–0·8 mm. lata, superne angustata, versus apicem subulata ; thecæ 1·3–1·7 mm. longæ. *Ovarium* trimerum, 2–4 mm. longum ; stylus (in *George* D) 12 mm. longus ; parte communi 8 mm.

longa, ramis tribus 4–4·8 mm. longis; stigmata linearia vel lineari-filiformia, 2·2–2·5 mm. longa; ovula 35–100 (11–33 pro placenta), 0·4–0·5 mm. longa. *Capsula* 2·5–4 mm. longa; semina numerosa (23 in *George* C), ovoidea vel ellipsoidea, 0·8–1·2 mm. longa, minute pubescentia vel scabrida. (Pl. **16**, *e*).

WESTERN AUSTRALIA. Without definite locality, Sept. 1903, *Fitzgerald*! (type). Murrin-Murrin, 1902, *W. J. George* C! D! (Herb. Berol.).

The specimen last enumerated exhibits in various characters, such as the indumentum of the leaves, the calyx, and the stigmas an approach to *F. fecunda* Summerhayes, but agrees in habit, and especially in the inflorescence, with the other two specimens cited above.

18. F. FECUNDA Summerhayes, sp. n.

Caules inferne nudi, superne ramosi, foliosi, ad 13 cm. longi; rami juventute sparsiuscule pubescentes, demum glabri, facile decorticati, internodiis brevibus ad 9 mm. longis. *Folia* linearia, acuta vel subacuta, 3–6·5 mm. longa, 0·8–1 mm. lata, marginibus valde revolutis ita ut sulcata videantur, supra dense scabrido-pilosula, glandulis valde punctata, subtus dense pubescentia; costa subtus prominens ut pagina superior similiter induta; petiolus 0·7–1·2 mm. longa, superne per 0·2–0·3 mm. nudus; vagina extra pubescens. *Dichasia* brevia, subdensa, pluries furcata. *Bracteolæ* foliis conformes, 3·5–5·3 mm. longæ, 0·7–1 mm. latæ; petiolus 1–1·7 mm. longus. *Calyx* subfusiformis, 7·7–9 mm. longus, 2–3 mm. diametro, 5-costatus, extra costis glabris vel sparse patentim pubescentibus, inter costas puberulus, intus glaber; lobi ovati vel lanceolato-ovati, 1·5–2·3 mm. longi, basi 1·3–1·7 mm. lati, conduplicati, cuspide solida brevi vel ad 0·5 mm. longa. *Petala* 5, obovato-, anguste obovato- vel cuneato-spathulata, 13–16 mm. longa; limbus 2·7–4·5 mm latus; unguis 1–1·3 mm. latus. *Stamina* 6; filamenta linearia, 8·3–11·8 mm. longa, versus basin 0·5–1·0 mm. lata, sursum sensim attenuata, basi angustata; thecæ 1·2–1·7 mm. longæ. *Ovarium* 2–3 mm. longum, trimerum; stylus 8·5–10 mm. longus, parte communi 5–6·7 mm. longa, ramis tribus 3–3·5 mm. longis; stigmata linearia vel filiformia, 1·8–2·7 mm. longa (? 1·2: *George* B); ovula 60–70 (20–24 pro placenta), 0·2–0·3 mm. longa. (Pl. **16**, *n*).

WESTERN AUSTRALIA. Comet Vale, Nov. 1915, *Jutson* 46! (type) Murrin Murrin, 1902, *W. J. George* B! (Herb. Berol.).

19. F. MAGNIFICA Summerhayes, sp. n.—*F. pauciflora* DC., var. *paleacea* Diels in Engl. Bot. Jahrb. xxxv, 390 (1904).

Caules pauciramosi, ad 15 cm. longi, ut rami dense setuloso-pilosi, demum glabri, internodiis brevibus ad 1 cm. longis. *Folia* linearia vel oblongo-linearia, subacuta vel rotundata, 3–8 mm. longa, 0·8–1·5 mm. lata, marginibus valde revolutis, supra juventute dense patentim pilosa, demum glabra, glandulis punctata, subtus densissime pubescentia costa prominente indumento paginæ superiori simili excepta;. petiolus 0·8–1·2 mm. (rarius 0·5 mm. tantum) longus, apice per 0·2–0·3 mm. nudus; vagina extra glabra vel pubescens.

Dichasia pluries furcata, floribus confertis, ad apices ramulorum subcorymbose disposita. *Bracteæ* et *bracteolæ* oblongo-lineares, oblongo-ovatæ vel ovatæ, 3–5 mm. longæ, 1–2·7 mm. latæ, rotundatæ, supra præcipue prope margines dense setuloso-pilosæ, subtus densissime albido-pilosæ, costa subtus prominente; petiolus 1·3–2·5 mm. longus. *Calyx* anguste truncato-ellipsoideus, 7·3–12·3 mm. longus, medio 2·3–3·2 mm. diametro, valde 5-costatus, extra costis longiuscule patentim setuloso-pilosis, inter costas breviter pubescens, intus partibus intercostalibus pubescentibus exceptis glaber; lobi lanceolati usque oblongo-ovati, acuti vel acuminato-subulati, 1·2–2·5 mm. longi, basi 1·2–1·8 mm. lati, cuspide solida ad 1 mm. longa, conduplicati. *Petala* 5, flabellato- vel obovato-spathulata, 1·5–2·5 (rarissime 1·15) cm. longa; limbus 7–11·5 mm. longus, 5–7·5 mm. latus. *Stamina* 5–6; filamenta linearia, 8–20 mm. longa, 0·7–1 mm. lata, superne subulata; thecæ 1·7–2 mm. longæ. *Ovarium* 2·5–4·5 mm. longum, trimerum; stylus 8·2–15·5 mm. longus, parte communi 6–14 mm. longa, ramis tribus 1·5–2·2 mm. longis; stigmata clavata, 0·3 mm. longa; ovula 20–63 (6–21 pro placenta), 0·3–0·4 mm. longa. (Pl. 17, A–H.)

WESTERN AUSTRALIA. Mt. Narryer, Upper Murchison River, on white sandstone, 1902, *Tyson* 78! (type in Herb. Dept. Agric. W.A.) 1892 ?, *Tyson*! (*Diels* 7838 in Herb. Berol.).

Although the dates on these two specimens are different, it is probable that they both represent the same gathering.

§ 6. CINEREO-PUBERULÆ.

20. F. SUBTERES Summerhayes, sp. n.—*F. lævis* . . . . form with linear leaves, Max Koch in Trans. Roy. Soc. S. Austral. xxii, 103 (1898).

Caules erecti, inferne nudi, superne ramosi, ad 15 cm. alti, ut rami dense papillato-puberuli, pallide albido-fulvi, internodiis ad 1·6 cm. longis. *Folia* petiolata, subteretia, linearia, obtusa, subtus sulcata, 2·7–6·5 mm. longa, 0·8–1·2 mm. lata, supra dense breviter puberula, pallide albido-fulva, glandulis valde punctata, subtus dense albido-pubescentia; petiolus 0·5–1·2 mm. longus. *Flores* in dichasiis sæpius 3- (rarius 5-) floris. *Bracteolæ* foliis similes, interdum petiolo reductæ, ad 5·5 mm. longæ, 0·5–0·8 mm. latæ; petiolus 1–2 mm. longus. *Calyx* tubulosus, 7·2–7·4 mm. longus, 2–2·2 mm. diametro, extra dense breviter pubescens, intus glaber vel inter costas sparse pilosus; lobi lanceolato-ovati vel oblongo-lanceolati, acuti, 1·5–2·2 mm. longi, basi 1·2–1·5 mm. lati, introrsum concavi. *Petala* 5, elliptico-obovato- vel orbiculari-obovato-spathulata, 10–12 mm. longa; limbus 4–5 mm. longus, 2·3–3·7 mm. latus. *Stamina* 6; filamenta linearia, 6·8–10·8 mm. longa, 0·4–0·6 mm. lata, superne subulata, basi angustata; thecæ 1·5 mm. longæ. *Ovarium* 2–3·2 mm. longum, trimerum; stylus 6–8 mm. longus, parte communi 4·7–6·8 mm. longa, ramis tribus 1–1·5 mm. longis; stigmata linearia, 0·5–1 mm. longa; ovula 19–31 (6–11 pro placenta), 0·3–0·4 mm. longa. (Pl. 16, *m*.)

SOUTH AUSTRALIA. Mt. Lyndhurst, Oct. 1898, *M. Koch* 41 ! (type). Without exact locality, 1900, *W. Gill* ! Leigh's Creek District, 1923-24, *Basedow* 41 ! (Herb. Berol.).

From the nature of the label it seems likely that Basedow's specimen in Herb. Berol. was really collected by Koch, and is therefore part of the type-collection.

21. F. FOLIOSA J. M. Black in Trans. Roy. Soc. S. Austral., xlii, 177, t. 17, figs. 7–9 (1918); Fl. S. Austral. 391, t. 36, figs. 7–9 (1926).—*F. pauciflora* DC., var. *thymoides* Benth. Fl. Austral. i, 152 (1863).

Fruticulus 7–19 cm. altus; caules multiramosi, erecti, dense brunnescenti-pubescentes, demum glabri, internodiis ad 1 cm. longis. *Folia* in fasciculis axillaribus, subsessilia, patentia vel nonnulla reflexa, linearia vel lineari-oblonga, rotundata, 3·5–7 (2·2–4: *Beckler*) mm. longa, 0·8–1·5 mm. lata, marginibus revolutis, utrinque minute pubescentia et glandulis punctata, costa subtus prominente. *Flores* in dichasiis pluries furcatis apicibus ramulorum corymbose dispositis. *Bracteolæ* foliis similes, sessiles, 2–3 mm. longæ, 0·6–1 mm. latæ. *Calyx* elongato-ovoideus, 4·5–6 mm. longus, 1·8–2·5 mm. diametro, extra dense pubescens, intus lobis pubescentibus exceptis glaber, nitens; lobi lanceolati, ovati, acuti vel apiculati, 1·2–2 mm. longi, basi 1 mm. lati, conduplicati. *Petala* 5, late flabellato-spathulata, limbo in unguem sensim attenuato, 7·7–9·2 mm. longa, 3·3–3·8 (2–2·3: *Beckler*) mm. lata. *Stamina* 6–7; filamenta linearia, 5–6·5 (ad 8·5: *Beckler*) mm. longa, 0·4–0·6 mm. lata, 2·5 mm. supra basin quam alibi latiora, abhinc deorsum et versus apicem angustata; thecæ 1–1·3 mm. longæ. *Ovarium* 1·8–2·8 mm. longum, trimerum; stylus 4·6–5·3 (6–6·8: *Beckler*) mm. longus, parte communi 2·8–3·5 (5·6: *Beckler*) mm. longa, ramis tribus 1·8–2 (0·8–1·5: *Beckler*) mm. longis; stigmata clavata, 0·3–0·6 mm. longa; ovula 35–38 (12–13 pro placenta) (in *Beckler* 18–20) fusiformia, 0·3–0·4 mm. longa, micropyle inferiore. *Capsula* non visa; semina (in specimine coll. *Beckler*) ovato-fusiformia, 1 mm. longa, minute transverse rugulosa.

SOUTH AUSTRALIA. Hergott (Marree), Oct. 1917, *J. M. Black* ! (type). Also, according to J. M. Black, at Farina and in Victoria at Sea-Lake.

NEW SOUTH WALES. Mt. Goningbeer (Koonenberry), Dec. 1860, *Beckler* ! Beckler's specimen has shorter leaves than the more luxuriant parts of the type, but agrees in all important characters.

22. F. MUSCOSA J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 177, t. 17, figs. 19–20 (1918); Fl. S. Austral. 391, t. 36, figs. 19–20 (1926).—*F. lævis* F. Muell. Ann. Rep. Govern. Bot. Victoria, 1862–3, 11 (1863), partim, non L. *F. pauciflora* Ewart & Davies, Fl. Northern Territ. 195 (1917), partim, non DC.

Fruticulus humilis, compactus, pulvinatus; caules prostrati, multiramosi, ad 12 cm. longi, dense minute cinerascenti- vel ferrugineo-pubescentes, internodiis raro ad 6 mm. longis. *Folia* sessilia vel subsessilia, lineari-cylindrica, sæpe versus apicem quam alibi latiora, patentia vel interdum reflexa, obtusa

vel rotundata, 1·5–3·2 mm. longa, 0·7–1·2 mm. diametro, marginibus revolutis, supra dense minute pubescentia, crusta alba tecta, subtus pubescentia, costa subtus prominente; vagina sursum producta, folia ergo basi anguste alata. *Flores* solitarii, vel in dichasiis 3-floris. *Bracteolæ* foliis conformes, 1·3–2·2 mm. longæ, 0·7–1 mm. latæ. *Calyx* cupiformis, 4·5–5·5 mm. longus, 1·7–2·5 mm. diametro, extra minute pubescens, intus partibus intercostalibus puberulis exceptis glaber; lobi oblongo-lanceolati usque ovati, 1–1·5 mm. longi, basi 1–1·2 mm. lati, introrsum concavi vel conduplicati. *Petala* 5, flabellato- vel obovato-spathulata, 5·7–9 mm. longa; limbus 2·7–4·8 mm. longus, 2–3 mm. latus. *Stamina* 6–8; filamenta linearia, 3·8–7 mm. longa, infra medium 0·4–0·6 mm. lata, utroque angustata; thecæ 0·7 mm. longæ. *Ovarium* 2·2 mm. longum, trigonum; stylus 4·5–6·2 mm. longus, parte communi 3–4·5 mm. longa, ramis tribus 1·5–2 mm. longis; stigmata clavata, 0·2–0·4 mm. longa; ovula 7–11 (2–4 pro placenta), 0·3–0·4 mm. longa, funiculis longiusculis superne refractis. *Capsula* 2·3–2·5 mm. longa; semina 5–8, ovoidea vel anguste ellipsoidea, 1 mm. longa, dense papillosa.

SOUTH AUSTRALIA. Dalhousie Springs, Aug. 1913, *S. A. White* (syntype) (not seen). Feb. 1911, *G. F. Hill*! (Herb. Berol.).

CENTRAL AUSTRALIA. Finke River, between Crown Pt. and Horseshoe Bend, Aug. 1913, *S. A. White*! (syntype). Interior of Australia (probably Finke River) (?) 1859, *Stuart* C

The date of the label of the last specimen (1859) is probably incorrect. In F. Mueller's enumeration of the plants collected by Stuart in 1860–2 he gives *Frankenia lævis* L. var. as occurring at Finke River. The sheet in Herb. Hook. at Kew contained material of no fewer than four different species collected by Stuart, so one cannot be sure whether Mueller actually included *F. muscosa* in the above record.

§ 7. INTERMEDIÆ.

23. F. CUPULARIS Summerhayes, sp. n.—*F. serpyllifolia* Osborn in Trans. Roy. Soc. S. Austral. xlvii, 397 (1923), in obs., non Lindl.

Caulis ramosus, 23 cm. longus, ut rami primum dense pubescens demum glabrescens, internodiis ad 2·8 cm. longis. *Folia* omnia desunt. *Inflorescentiæ* ad 15 cm. longæ; dichasia irregularia, sæpe in monochasia falsa transientia. *Bracteæ* et *bracteolæ* inter se similes, lanceolatæ, oblongo-lanceolatæ vel lanceolato-ovatæ, breviter petiolatæ, acutæ, 2–4·3 mm. longæ, 0·7–1·8 mm. latæ, supra præsertim versus margines sparse patentim pilosæ, subtus densissime pilosulæ, costa subtus prominula vel prominente glabra; petiolus bractearum longe ciliatus; vagina communis bractearum et bracteolarum cupularis, basin calycis per 0·5–1 mm. amplectens. *Calyx* 5 mm. longus, 1·4 mm. diametro, extra sparse vel densiuscule patentim pilosus; lobi acuminati, 0·6–1 mm. longi, basi 0·6–0·8 mm. lati. *Petala* 5, obovato-spathulata, 5·8–6 mm. longa; limbus 2·5 mm. longus, 1·6–2 mm. latus. *Stamina* 6; filamenta 3·5 mm. longa, 0·3–0·5 mm. lata; thecæ non visæ. *Ovarium* non visum; stylus 3·7–4 mm. longus, parte communi 2·5 mm. longa; ramis tribus 1·3–1·5 mm. longis, stigmata lineari-clavata, 0·3–0·5 mm. longa. *Capsula* 3 mm. longa; semen 1, ovoideum, utroque obtusum vel subacutum, 1 mm. longum, minutissime rugosum, reticulatum; ovula abortiva 29–30 (9–10 pro placenta).

SOUTH AUSTRALIA. Koonamore, gypsum salt-lake, Aug. 1923, *Osborn*! (type).

24. F. PSEUDO-FLABELLATA Summerhayes, sp. n.

Caulis satis ramosus, 12 cm. longus, pilis patentibus leviter retrorsis densiuscule indutus, internodiis ad 1·2 cm. longis. *Folia* ovata, elliptico-ovata vel oblongo-elliptica, subacuta usque rotundata, 2·5–3·5 mm. longa, 1·5–2·2 mm. lata, supra densiuscule pubescentia, demum interdum glabrescentia, subtus minute puberula, costa subtus prominula; petiolus 0·5–0·7 mm. longus, ciliatus. *Flores* in dichasiis multoties furcatis ramulis inæqualibus. *Braceteolæ* foliis conformes, 2·5–3·7 mm. longæ, 1·7–2 mm. latæ. *Calyx* 5·2–5·5 mm. longus, 1–1·2 mm. diametro, extra costis sparsiuscule setuloso-pilosis, inter costas glaber vel papillato-puberulus; lobi acuti, 1–1·4 mm. longi, basi 0·7–0·8 mm. lati, conduplicati. *Petala* 5, flabellato-spathulata, 6·3–7 mm. longa; limbus 2·3–2·6 mm. longus, 2–2·7 mm. latus, superne truncatus. *Stamina* 6; filamenta 4·5–6 mm. longa, 0·2–0·3 mm. lata; thecæ 0·8–1 mm. longæ. *Ovarium* 2·5 mm. longum, trimerum; stylus 4·8 mm. longus, parte communi 4 mm. longa, ramis tribus 0·8–0·9 mm. longis; stigmata clavata, 0·3 mm. longa; ovula 12–23 (4–8 pro placenta), 0·3–0·5 mm. longa. *Capsula* 3 mm. longa; semina immatura 5, 0·8 mm. longa.

SOUTH AUSTRALIA. Lake Harry, near Hergott (Marree), 1905, *W. Gill*! (type).

A remarkable plant resembling in outward aspect *F. flabellata* Sprague, but easily distinguished by the numerous ovules as well as by other minor characters.

25. F. ADPRESSA Summerhayes, sp. n.

Caules divaricate ramosi, ad 23 cm. longi, longiuscule patentim pubescentes, internodiis ad 2·5 cm. longis. *Folia* oblongo-linearia vel oblanceolata, acuta vel obtusa, 3–5 mm. longa, 1–2 mm. lata, folia juvenilia ± dense adpresse pilosa, demum supra fere glabra, pilis perpaucis adpressis instructa, subtus dense adpresse pubescentia; petiolus 1–1·3 mm. longus, longe ciliatus. *Dichasia* laxa, septies usque novies furcata, ramulis divaricatis. *Bracteolæ* foliis conformes, 2·7–4·7 mm. longæ, 0·8–1·3 mm. latæ; petiolus 0·7–1·3 mm. longus. *Calyx* 6·3–6·5 mm. longus, 1·2 mm. diametro, extra costis præter lineam mediam glabram præcipue versus basin adpresse pilosis, inter costas superne puberulus; lobi acuminati, 1–1·3 mm. longi, 0·6–0·8 mm. lati, conduplicati. *Petala* 5, flabellato-spathulata, 8·5–9·3 mm. longa; limbus 3·8–4·2 mm. longus, 2·8 mm. latus. *Stamina* 6; filamenta 5·5–7·3 mm. longa, 0·2–0·4 mm. lata; thecæ 1 mm. longæ. *Ovarium* 2·3 mm. longum, 0·6–0·7 mm. diametro, trimerum; stylus 5–5·5 mm. longus, parte communi 3–3·7 mm. longa, ramis tribus 1·8 mm. longis; stigmata linearia, 0·7 mm. longa; ovula 13–20 (4–7 pro placenta), 0·3–0·4 mm. longa.

QUEENSLAND. S.W. Queensland, Nov. 1899, *Koch*! (type in Herb. Berol.). Closely resembling in general habit *F. serpyllifolia* Lindl. and occurring within the range of that species. A close investigation, however, reveals many differences apart from the ovular distinction.

§ 8. PUBESCENTES.

26. F. DENSA Summerhayes, sp. n.—*F. serpyllifolia* Lindl., var. *eremophila* J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 179 (1918), partim. *F. serpyllifolia* J. M. Black, Fl. S. Austral. 393 (1926), partim, non Lindl.

Caules procumbentes, multiramosi, ad 15 cm. longi, foliosi, internodiis brevibus ad 1 cm. longis. *Folia* linearia, lanceolata vel anguste oblonga, acuta vel obtusa, basi sæpe angustata, 1·5–4·8 mm. longa, 0·5–1·3 mm. lata, marginibus satis revolutis, utrinque dense minute pubescentia, supra glandulis punctata; petiolus 0·3–1 mm. longus. *Dichasia* brevia, densa, interdum irregularis ramulis foliosis. *Bracteolæ* 1·7–4·2 mm. longæ, 0·5–1 mm. latæ, 0·3–1 mm. petiolatæ. *Calyx* dimidio superiore sursum sensim dilatatus, 3·8–5·7 mm. longus, 1–1·5 mm. diametro, extra valde 5-costatus, præter costas superne glabras dense breviterque pubescens; lobi triangulari-ovati vel triangulari-lanceolati, acuti, cuspidati, 0·5–1·5 mm. longi, basi 0·6–1 mm. lati, cuspide solida ad 0·2 mm. longa, introrsum concavi. *Petala* 5, cuneato-ad transverse elliptico-spathulata, 5·8–8·8 mm. longa; limbus 2·5–4·3 mm. longus, 2–3·5 mm. latus. *Stamina* 5–6; filamenta filiformi-linearia vel linearia, 4·2–6 (in typo 5·5–7·3) mm. longa, 0·1–0·5 mm. lata, basi et apice angustata; thecæ 0·6–1 mm. longæ. *Ovarium* 1·5–2·5 mm. longum, 2–3-merum; stylus 4–5·3 mm. longus, parte communi 3–3·8 mm. longa, ramis duobus vel tribus 0·7–1·8 mm. longis; stigmata clavata vel linearia, 0·2–0·7 mm. longa; ovula 2–6 (1–2 pro placenta), 0·3–0·7 mm. longa, funiculis superne refractis basi per 0·3–0·5 mm. ad valvas adnatis. *Capsula* 2·5–2·8 mm. longa; semina 1–3, ovoidea vel anguste ellipsoidea, 1·2–1·5 mm. longa, dense minute pubescentia.

SOUTH AUSTRALIA. Nullarbor pastoral country, west of Fowler's Bay, Jan. 1926, comm. *T. G. B. Osborn*! (type). Fowler's Bay, Oct. 1907, *Mrs. T. Brown*! Yalata, Fowler's Bay, *Tate*! (Herb. Adelaide). Head of Great Australian Bight, Sept. 1879, *Richards*! (Herb. Adelaide).

WESTERN AUSTRALIA. Israelite Bay, March 1902, *J. P. Brooke*! (Herb. Dept. Agric. W.A.).

27. F. SCABRA Lindl. in Mitchell, Journ. Trop. Austral. 305 (1848).—*F. pauciflora* Benth. Fl. Austral. i, 151 (1863), partim ; Bailey, Queensl. Fl. 53 (1899), partim ; non DC.

Caules adscendentes vel erecti, ad 12 cm. longi, multiramosi, internodiis brevibus. *Folia* linearia vel lineari-oblonga, rotundata vel obtusa, 2·8–4·5 mm. longa, 0·5–1·3 mm. lata, marginibus valde revolutis, supra dense scabrido-pilosula, subtus dense papillato-pilosula ; petiolus 0·3–0·6 mm. longus. *Bracteolæ* 2 mm. longæ, 0·3 mm. latæ ; petiolus 1–1·2 mm. longus. *Calyx* 3·3–4·8 mm. longus, 1–1·5 mm. diametro, 5-costatus, extra dense breviter setuloso-pubescens ; lobi ovati, acuti vel fere acuminati, 0·8–1 mm. longi, basi 0·6–0·8 mm. lati, acumine solido 0·2–0·3 mm. longo, introrsum concavi vel conduplicati. *Petala* 5, obovato-spathulata, 5·2–6·8 mm. longa, limbus 2·3–3·2 mm. longus, 1·5–2·2 mm. latus. *Stamina* 6 ; filamenta linearia, 3·8–5·2 mm. longa, 0·3 mm. lata, basi angustata, apice subulata ; thecæ 0·7–1 mm. longæ. *Ovarium* 1·8–2·3 mm. longum ; stylus 4 mm. longus, parte communi 2·5 mm. longa, ramis tribus 1·5 mm. longis ; stigmata capitata, 0·1 mm. diametro ; ovula 3, 0·7–1·5 mm. longa.

QUEENSLAND. Nive River, Sept. 1846, *Mitchell* 617 ! (type in Herb. Cantab.).

I have also seen a specimen in Herb. Berol., collected by Max Koch at Clermont (Queensland) in October 1899. This agrees with *F. scabra* in general facies, and can probably be referred to that species. However, the indumentum differs from that of *F. scabra*, while the leaves and flowers are rather larger. These differences are as follows :—Leaves 4–6 mm. long, 0·5–0·7 mm. wide, calyx 4·5–7 mm. long, petals 7·4–8 mm. long, filaments 5·6–6·7 mm. long, thecæ 1·2 mm. long. The capsule in this specimen was 3·2 mm. long ; seed 1, 2·6 mm. long, 0·6 mm. wide, smooth. The differences seem rather too great to admit of naming this specimen with certainty as *F. scabra*, but are insufficient to justify the creation of a new species. More material from this part of Queensland is desirable.

28. F. ANGUSTIPETALA Summerhayes, sp. n.—*F. pauciflora* Benth. Fl. Austral. i, 151 (1863), partim, non DC.

Caules procumbentes vel adscendentes, rarius erecti, ad 19 cm. longi ; rami adscendentes, ad 7 cm. longi, floriferi, internodiis ad 3 cm. longis. *Folia* lanceolata vel oblonga ad ovata vel elliptica, obtusa vel rotundata, interdum emarginata, basi rotundata, 1·7–5·5 mm. longa, 0·7–3·3 mm. lata, junioria marginibus modice revolutis demum leviter revolutis vel fere planis, supra ± dense pubescentia, subtus dense albido-pilosula ; petiolus 0·5–1·2 mm. longus. *Dichasia* brevia, ad apices ramulorum. *Bracteolæ* 1–4·5 mm. longæ, 0·5–2·3 mm. latæ, 0·3–0·7 mm. petiolatæ. *Calyx* 5–6·3 (ad 7·3 : *Reader*) mm. longus, 1–1·5 (ad 1·8 : *Reader*) mm. diametro, extra 4–6-costatus, costis dense pubescentibus, inter costas papillato-pilosulus ; lobi lanceolati vel ovati, 0·7-1·3 (ad 1·7 : *Reader*) mm. longi, basi 0·5–0·8 (ad 1·2 : *Reader*) mm. lati, acuti, cuspidati, cuspide solida ad 0·3 mm. longa, introrsum concavi.

Petala 5-6, obovato- vel anguste flabellato-spathulata, 6·7–10·3 mm. longa; limbus 2·3-5 mm. longus, 1·5–3 mm. latus. *Stamina* 6, rarius 7; filamenta linearia vel filiformia, 4·3–8·5 mm. longa, 0·1–0·3, rarissime ad 0·6 mm. lata, superne subulata; thecæ 0·8–1·2 mm. longæ. *Ovarium* 1·8–3 mm. longum; stylus 4–7·3 mm. longus, parte communi 2·3–4·2 mm. longa, ramis tribus 1–3·2 mm. longis; stigmata linearia vel lineari-filiformia, 0·3-1 (rarius ad 1·2: *Reader*) mm. longa; ovula 3, rarius 4–5, 0·5-1 mm. longa.

New South Wales. Bilbarku, Darling River, Oct. 1860, *Beckler*! (type). From Doroodoo to Vangarna, 1860, *Beckler*! Darling River, *F. Mueller*!

Victoria. Mallee Country, Nov. 1896, *F. M. Reader*! Northern Mallee, Oct. 1898, *C. Walter*! Murrayville, Oct. 1928, *H. B. Williamson*!

29. F. eremophila Summerhayes, sp. n.—*F. serpyllifolia* var. *eremophila* J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 179 (1918), partim. *F. serpyllifolia* J. M. Black, Fl. S. Austral. 393 (1926), partim, non Lindl.

Caules erecti, superne ramosi, ad 22 cm. longi, internodiis ad 2 cm. longis. *Folia* linearia usque oblongo-elliptica, subteretia, rotundata vel acuta, 2·7–7·8 mm. longa, 0·7–3 mm. lata, marginibus ±revolutis, supra sparsissime scabrido-pilosula vel glabra, interdum punctata, subtus dense albido-pubescentia; petiolus 0·5-1·5 mm. longus. *Dichasia* brevia. *Bracteolæ* 1·2-5 mm. longæ, 0·7-2 mm. latæ, 0·5-1·5 mm. petiolatæ. *Calyx* 4·5–5·5 mm. longus, 1-1·5 mm. diametro, extra 4-5-costatus, costis glabris vel pubescentibus, inter costas puberulus; lobi lanceolati vel triangulari-lanceolati, acuti, 0·7–1·2 mm. longi, basi 0·5-1 mm. lati, conduplicati, cuspide solida 0·2–0·3 mm. longa. *Petala* 4-5, anguste obovato- vel flabellato-spathulata, 6·7–8·5 mm. longa; limbus 3·2–4·5 mm. longus, 1·5–2·8 mm. latus. *Stamina* 6 vel rarissime 8; filamenta anguste linearia, 4·5–7·5 mm. longa, 0·1–0·4 mm. lata; thecæ 0·6–1 mm. longæ. *Ovarium* 1·7–2 mm. longum; stylus 4·2–5·5 mm. longus, parte communi 2·7–3 mm. longa, ramis tribus 1·5–2·5 mm. longis; stigmata linearia vel lineari-filiformia, 1-1·5 mm. longa; ovula 3, 0·8–1·3 mm. longa.

South Australia. Fowler's Bay, Oct. 1907, *Mrs. T. Brown*! (type). Euria, Nov. 1879, *Richards*! (Herb. Adelaide). Ooldea, Sept. 1879, *Tietkens*! (Herb. Adelaide).

30. F. connata Sprague in Kew Bull. 1925, 426.—*F. serpyllifolia* J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 178, t. 17, figs. 9–10 (1918), partim; Ising in Trans. Roy. Soc. S. Austral. xlvi, 601 (1922), partim; J. M. Black, Fl. S. Austral. 393 (1926), partim; non Lindl.

Fruticulus ad 15 cm. altus, caulibus procumbentibus usque erectis gracilibus ad 30 cm. longis ramos florentes numerosos breves laterales ad 6 cm. longos gerentibus, internodiis longiusculis ad 3 cm. longis. *Folia* linearia, lanceolata vel anguste oblonga, rarissime oblongo-elliptica, sæpius obtusa vel rotundata, interdum subacuta, 2–8·5 mm. longa, 0·7–2 mm. lata, rarissime (*Tate* 16) ad 2·6 mm. lata, marginibus sæpius valde revolutis sæpissime saltem dimidium paginæ inferioris laminæ occultantibus, supra breviter dense pubescentia, subtus dense minute albido-pilosula costa pubescente excepta; petiolus 0·4–1·5 mm. longus. *Dichasia* sæpius laxiuscula. *Bracteolæ* foliis similes, superiores ovatæ vel ovato-oblongæ, 1–4·3 mm. longæ, 0·7–1·3 (–1·7: *Menzel*) mm. latæ; petiolus 0·4–1·3 mm. longus. *Calyx* 6·7–8·6 (8·7–10: *Osborn*, Dilkera; 5·8–6·3: *Tate* 16) mm. longa, 1·2–2 mm. diametro, 5-costatus, extra costis dense breviter pubescentibus, inter costas puberulus; lobi oblongo-lanceolati usque oblongo-ovati, acuti, cuspidati, 1–2 (0·5–1: Warrego River; 0·7–1·2: *Tate* 16) mm. longi, basi 0·6–1 mm. lati, cuspide solida nulla vel ad 0·5 mm. longa, introrsum concavi vel conduplicati. *Petala* 5, flabellato- vel rarius obovato-spathulata, 9·5–13·5 mm. longa; limbus 3·7–7 mm. longus, 2–6 mm. latus, rotundato-truncatus. *Stamina* 6; filamenta linearia, 6·2–10·8 mm. longa, 0·2–0·5 mm. lata, superne subulata; thecæ 1–1·4 (0·8–1: *Ising* 1716, *Menzel*, *Andrews*) mm. longæ. *Ovarium* 1·5–3 mm. longum; stylus 6–9·5 mm. longus, parte communi 3·4–7 mm. longa, ramis tribus 2–3·3 mm. longis; stigmata linearia vel filiformia, 0·7–1·5 mm. longa; ovula 3, 0·6–1 (rarius 0·3–0·5) mm. longa. *Capsula* (unica visa) 4·2 mm. longa; semina 3, fusiformia, 2–2·4 mm. longa, lævia, subtiliter reticulata. (Pl. **16**, *g*.)

SOUTH AUSTRALIA. Leigh's Creek, Oct. 1917, *J. M. Black* 2! (type). Tarcoola, Sept. 1920, *Ising* 1716! Koonamore, Black Hill, by washes at roadside *Kochia planifolia* plain (not saline), Dec. 1924, *Osborn*! Dilkera, near Morgan Murray River basin, on flooded flat, 1923, *Osborn*! Without exact locality, Apr. 1884, *Tate* 16! (Herb. Adelaide).

CENTRAL AUSTRALIA. Alice Springs, *O. E. Menzel*!

NEW SOUTH WALES. Broken Hill, Sept. 1918, *E. C. Andrews*!, May 1920, *A. Morris*! Pine Creek, Broken Hill, Aug. 1921, *A. Morris*! 37 miles from Wanaaring (Ularara Cty.), Oct. 1912, *Boorman*! Warrego River, no collector (possibly *E. Betche*)! Without exact locality, *Sturt*! (Herb. Mus. Brit.).

Menzel's specimen from Alice Springs shows an approach to *F. serpyllifolia* Lindl. in its rather longer indumentum and slightly less tightly rolled leaves, but in all other respects agrees with the typical form.

31. F. LATIOR Sprague & Summerhayes, sp. n.—*F. interioris* var. *conspicua* Ostenf. in Dansk Bot. Arkiv, ii, 54 (1918).

Caules procumbentes vel adscendentes, multiramosi, ad 25 cm. longi, internodiis ad 3·3 cm. longis. *Folia* superiora oblongo-linearia vel lanceolata, inferiora ovato-elliptica vel elliptico-oblonga, rotundata vel obtusa, 3–10 mm. longa, 0·8–3·7 mm. lata, juventute marginibus modice revolutis, demum leviter revolutis vel planis, supra dense pubescentia, demum glabrescentia vel rarius glabra, subtus breviter pubescentia; petiolus 0·5–1 (rarius ad 1·7) mm. longus. *Dichasia* interdum in monochasia falsa transientia, sæpius ramulis brevibus lateralibus. *Bracteolæ* 2–4·5 mm. longæ, 0·8–1·8 mm. latæ; petiolus 0·3–0·7 (ad 1: *Betche*) mm. longus. *Calyx* 6·5–8·7 mm. longus, 1–1·5 mm.

diametro, extra 5-costatus, costis breviter dense patentim setulosis, inter costas minute papillatus vel pilosulus ; lobi oblongo-lanceolati, acuminati, conduplicati, 0·8–1·5 mm. longi, basi 0·5–1 mm. lati, acumine solido 0·3–0·8 mm. longo. *Petala* 5, flabellato- vel obovato-spathulata, 8·3–12·7 mm. longa ; limbus 3·7–5·2 (–5·7 : *Irvine*) mm. longus, 2·7–4·2 (2 tantum : *Irvine*) mm. latus. *Stamina* 6 ; filamenta linearia, 6–11·3 mm. longa, 0·1–0·5 mm. lata, basi breviter angustata, superne subulata ; thecæ 1–1·6 (0·8–1·1 : *Irvine*) mm. longæ. *Ovarium* 1·5–3·7 mm. longum ; stylus 6–10 mm. longus, parte communi 3–5·8 mm. longa, ramis duobus (*Betche*) vel tribus 2·5–4·2 mm. longis ; stigmata linearia vel filiformia, 0·6–2 mm. longa ; ovula 3, 0·4–0·8 mm. longa. *Capsula* ignota ; semen 1, quadrato-cylindricum, 1·5–1·7 mm. longum, stramineum, læve.

New South Wales. Between Zara and Wangonilla, March 1917, *E. Officer* ! (type). Paroo River, Tooralc-Goonerz, Oct. 1912, *Boorman* ! Barrier Range, *Mrs. Irvine* ! (Herb. Mus. Brit., Herb. Berol.) " Coolgardie Goldfields, Oct. 1908, *J. Wood* " ! (Herb. Copenhagen.). Warrego River, Oct. 1882, *E. Betche* ! (Herb. Berol.).

The type-specimen of *F. interioris* var. *conspicua* Ostenfeld is labelled as coming from " Coolgardie Goldfields, W.A.," but agrees completely with *F. latior.* § Pubescentes is, as far as is known, confined to eastern Australia, and has only been discovered in Western Australia at Israelite Bay. Dr. Ostenfeld writes that some of the plants received from the National Herbarium of New South Wales in the same batch as the specimen in question had been incorrectly labelled, and that possibly this applied to the type of *F. interioris* var. *conspicua.* From the evidence it seems almost certain that this is so, and that the specimen was collected in eastern Australia, probably in New South Wales.

32. F. planifolia Sprague & Summerhayes, sp. n.—*F. lævis*, form with ovate leaves, Max Koch in Trans. Roy. Soc. S. Austral. xxii, 103 (1898), non L. *F. serpyllifolia* J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 178 (1918), partim ; Fl. S. Austral. 393 (1926), partim ; non Lindl.

Caules e caudice lignoso erecti vel adscendentes, ramosi, ad 21 cm. longi, internodiis ad 3 cm. longis. *Folia* longe petiolata, ovato-lanceolata, ovata, obovata, oblonga vel elliptica, acuta ad rotundata, interdum retusa, basi cuneata vel rotundata, 3·5–10·5 (2–4·5 : *Murray*) mm. longa, 2–6·8 (1–2·4 : *Murray*) mm. lata, marginibus tantum leviter revolutis, supra dense breviter pubescentia, subtus dense albido-puberula, glandulis punctata, costa pubescente ; petiolus 1–2·5 (0·6–1 : *Murray*) mm. longus. *Dichasia* interdum subcapitata, sed sæpius inferne laxa. *Bracteolæ* foliis similes sed pro rata angustiores, acutæ, 2·5–5·5 mm. longæ, 1·3–2·8 mm. latæ ; petiolus 0·8–1·2 mm. longus. *Calyx* 6·2–7 (8·3–8·8 : *Basedow* 10 ; 5·2 : *Murray*) mm. longus, 1·4–1·8 mm. diametro, extra 5-costatus, costis dense pubescentibus, inter costas superne puberulus, inferne pubescens ; lobi lanceolati vel oblongo-lanceolati, acuti, 0·8–2 mm. longi, basi 0·7–1·2 mm. lati, cuspide solida 0·2–

0·5 mm. longa pubescente, conduplicati. *Petala* 5, obovato- vel flabellato-spathulata, 7·3–9·5 (11·5–12·5: *Basedow* 10) mm. longa; limbus 3·5–5·3 mm. longus, 2–3·7 mm. latus, subtruncato-rotundatus. *Stamina* 5–6; filamenta linearia, 5–9 mm. longa, 0·2–0·5 mm. lata, superne subulata; thecæ 1–1·3 (0·7–0·8: *Murray*) mm. longæ. *Ovarium* 1·5–2·5 mm. longum; stylus 4·5–5·7, rarissime ad 9·3 mm. longus, parte communi 3–7 mm. longa, ramis tribus 1·2–2·3 mm. longis; stigmata anguste lineari-cylindrica, 1–1·5 mm. longa; ovula 3, 0·8–1·5 mm. longa. *Capsula* non visa. (Pl. 18.)

SOUTH AUSTRALIA. Mt. Lyndhurst, Oct. 1898, *Koch* 40! (type) May 1898, *Koch*! Lake Eyre, Sept. 1903, *Baldwin Spencer*! Central District (Tate), 1903, *Basedow* 10! 22! (Herb. Berol.). Tableland north of Callana, L. Eyre Basin, Apr. 1885, *M. Murray*! (Herb. Adelaide).

This last-cited specimen is a small-leaved form, but agrees with the type in floral characters.

33. F. FLABELLATA Sprague in Kew Bull. 1925, 427.—*F. serpyllifolia* J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 178 (1918), partim; Fl. S. Austral. 393 (1926), partim; non Lindl.

Fruticulus, 15–20 cm. altus; caules procumbentes usque erecti, ramosi, internodiis ad 2 cm. longis. *Folia* lanceolata, oblonga, ovata vel oblongo-elliptica, subacuta vel obtusa, basi rotundata, 2–6 mm. longa, 1·2–2·8 mm. lata, marginibus leviter revolutis, supra dense breviter pilosa, subtus minute pilosula; petiolus 0·3–0·8 mm. longus. *Dichasia* foliosa. *Bracteolæ* 2–3 mm. longæ, 0·8–1·5 mm. latæ, 0·4–0·8 mm. petiolatæ. *Calyx* 4·3–6 mm. longus, 1–1·5 mm. diametro, 5-costatus, extra costis breviter hispidulis, inter costas puberulus; lobi oblongo-ovati vel oblongo-lanceolati, acuti, cuspidati, 1–1·5 mm. longi, basi 0·7–1·2 mm. lati, cuspide solida brevi vel nulla, introrsum concavi. *Petala* 5, flabellato- vel obovato-spathulata, 6–7·8 mm. longa, 1·5–4 mm. lata. *Stamina* 6; filamenta linearia, 4·3–7 mm. longa, supra medium 0·3–0·5 mm. lata, utroque angustata; thecæ 0·8–1·2 mm. longæ. *Ovarium* 1·8–2·3 mm. longum, stylus 4·5–6 mm. longus, parte communi 3–4 mm. longa, ramis tribus 1·3–2 mm. longis; stigmata clavata vel capitata, 0·2–0·5 mm. longa; ovula 3, 1–1·5 mm. longa. *Capsula* 2·8 mm. longa; semen 1, ovoideo-pyriforme, 2 mm. longum, rugulosum.

SOUTH AUSTRALIA. Frome River, near Hergott (Marree), Nov. 1917, *J. M. Black*! (type).

QUEENSLAND. Roxborough Downs, western Queensland, Dec. 1895, *F. M. Bailey*! Diamantina River, July 1918, *S. W. Jackson*!

34. F. SERPYLLIFOLIA Lindl. in Mitchell, Journ. Trop. Austral. 305 (1848); J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 178, t. 16, figs. 7, 8, 11 (1918), partim; Sprague in Kew Bull. 1925, 426, desc. ampl.; J. M. Black, Fl. S. Austral. 392 (1926), partim.—*F. pauciflora* var. *serpyllifolia* Benth. Fl. Austral. i, 152 (1863), partim; Bailey, Queensl. Fl. 83 (1899), partim. *F. lævis* F. Muell. & Tate in Trans. Roy. Soc. S. Austral. xvi, 343 (1896), partim, non L. *F. pauciflora* var. *thymoides* Bailey in Queensl. Agric. Journ. xxv. 288

(1910), non Benth. *F. pauciflora* Ewart, Kerr & Derrick in Proc. Roy. Soc. Vict. xxxviii, 83 (1926), partim, non DC.

Caules erecti vel adscendentes, sæpius ad 18 cm, rarius ad 33 cm. longi; rami numerosi, internodiis longis ad 3·5 cm. longis. *Folia* ovata, oblonga vel elliptica, raro lanceolata, rotundata vel subacuta, 2·5–9 mm. longa, 1–4·7 (rarius 0·6 tantum) mm. lata, marginibus ±sæpius leviter revolutis, supra dense præsertim versus margines longiuscule pilosa, subtus costa excepta dense breviter pubescentia; petiolus 0·5–1·3 (raro 0·3 tantum) mm. longus. *Dichasia* pluries furcata, foliosa. *Bracteolæ* foliis similes sed sæpe angustiores, plerumque magis pilosæ, 2–6 mm. longæ, 0·8–1·8 (rarius 0·5 usque 3) mm. latæ; petiolus 0·7–1·5 (rarius 0·5) mm. longus. *Calyx* 5·5–7·5 (8·7–9·2: *Collier*) mm. longus, 1·3–1·8 mm. diametro, 5-costatus, extra costis longiuscule setuloso-pilosis vel hispidis, inter costas puberulus; lobi lanceolati vel oblongo-lanceolati, acuti, cuspidati, 1·3-2·2 (raro 1 mm. tantum) mm. longi, basi 0·5–1·3 mm. lati, cuspide solida 0·2–0·5 mm. longa, conduplicati. *Petala* 5, obovato- vel flabellato-spathulata, 7-10·8 (11·7-13: *Collier*) mm. longa; limbus 3·3–5·5 mm. longus, 2·2–4 (1·5–1·7: *Ewart*; 4–5·5: *Farley*) mm. latus. *Stamina* 6–7; filamenta linearia vel raro filiformia, 4·5-8·7 (8·5–10·5: *Collier*) mm. longa, medio 0·1–0·5 (0·5–0·7: *Bancroft*) mm. lata, utroque angustata, apice subulata; thecæ 0·8–1·5 mm. longæ. *Ovarium* 1·7-3·8 mm. longum; stylus 5·8–8·7 mm. longus, parte communi 3·3–7 mm. longa, ramis tribus 1·5–3·2 mm. longis; stigmata capitata, clavata vel breviter linearia, 0·2–0·5 (rarius ad 0·7) mm. longa; ovula 3, 0·7–1·5 mm. longa. *Capsula* 3·3 mm. longa; semen 1, ovoideo-pyriforme vel elongato-ovoideum, 2·3–2·7 mm. longum, læve vel rugulosum, reticulatum. (Pl. **16**, *a*.)

QUEENSLAND. Nive River, Sept. 1846, *Mitchell* 626! (type in Herb. Cantab.). Monkira Stn., West Queensland, Aug. 1891, *J. L. Debney*! Longreach, Aug. 1918, *Miss Bancroft*! Georgina River, western Queensland, Sept. 1910, *E. W. Bick*! South-western Queensland, June 1910, *J. Little*! North-western Queensland, *H. Farley*! Interior of Queensland, no collector!

SOUTH AUSTRALIA. Cootanoorinna, July 1891, *Helms*! Neales Creek, Odnadatta, May 1924, *Ewart*!

NEW SOUTH WALES. Milparinka, Oct. 1910, *C. H. Collier*!

Specimen without locality or other information, comm. Nat. Herb. N.S.W.!

Exceptional measurements. The specimen from Milparinka shows in the shape of the leaves and the size of the flowers an approach to *F. connata* Sprague, but agrees with *F. serpyllifolia* in the long indumentum and capitate stigmas among other characters.

§ 9. UNCINATÆ.

35. F. ANNUA Summerhayes, sp. n.

Herba annua; caules erecti, rarius adscendentes, cæspitosi, 3–9 cm. longi, inflorescentiis terminati, internodiis ad 1·8 cm. longis. *Folia* oblongo-elliptica, obovata vel lineari-oblonga, rotundata vel retusa, basi cuneata, 3–5 mm.

longa, 1–2·7 mm. lata, utrinque glabra vel folia inferiora in pagina superiore costa præcipue versus basin linea pilorum instructa; petiolus 1–3 mm. longus, superne ad 1·2 mm. nudus; vagina extra glabra. *Dichasia* pluries furcata. *Bracteolæ* 2–5 mm. longæ, 0·5–1·5 mm. latæ; petiolus 0·5–1·3 mm. longus. *Calyx* 5·3–6 mm. longus, 1–1·8 mm. diametro; lobi lanceolati vel lanceolato-ovati, acuti, 1·2–1·4 mm. longi, basi 0·7–1 mm. lati, cuspide solida 0·2–0·3 mm. longa, conduplicati. *Petala* 5, delicata, obovato-spathulata, 7·7–9 mm. longa; limbus 3–4 mm. longus, 2·7–3·3 mm. latus. *Stamina* 7–8; filamenta linearia, 5–7 mm. longa, 0·2–0·5 mm. lata, superne subulata; thecæ 0·8–1 mm. longæ. *Ovarium* 2–2·8 mm. longum, 3–4-merum; stylus 4·5–4·8 mm. longus, parte communi 2·8–3·3 mm. longa, ramis 3–4, 1·4–2 mm. longis; stigmata linearia vel lineari-clavata, 0·4–0·8 mm. longa; ovula 15–32 (5–11 pro placenta), parietalia 0·3–0·6 mm. longa. (Pl. 17, *a–g*.)

QUEENSLAND. Mulligan River, Feb. 1904, *H. Clarke*! (type).

The production of flowers at a very early stage and their relative abundance suggests that this is an annual, but the plants may possibly be the seedling stage of some unknown shrubby species. In general characters, with the exception of the ovules, the plant agrees with the other species of § Uncinatæ.

36. F. GRACILIS Summerhayes, sp. n.—*F. pauciflora* Benth. Fl. Austral. i, 151 (1863), partim, non DC.

Caules adscendentes vel erecti, ad 20 cm. longi, graciles, ramis multis virgatis, internodiis ad 2·3 cm. longis. *Folia* linearia, oblongo-linearia, vel lineari-oblanceolata, obtusa vel acuta, basi sæpe angustata, 2·7–6·2 mm. longa, 0·5–1·5 mm. lata, supra glabra vel sparse scabrido-pilosula, glandulis valde punctata, subtus costa glabra excepta dense pubescentia vel puberula; petiolus 0·3–1 mm. longus; vagina extra glabra vel rarius pubescens. *Dichasia* pluries furcata, laxiuscula, ramulis sæpius divaricatis. *Bracteæ* et *bracteolæ* 0·7–5 mm. longæ, 0·4–1 mm. latæ, 0·3–0·8 mm. petiolatæ. *Calyx* raro basi subdilatatus, 5–7·3 mm. longus, 1–1·8 mm. diametro; lobi lanceolati vel lanceolato-ovati, acuti vel acuminati, cuspidati, conduplicati, 0·7–2·2 mm. longi, basi 0·5–1 mm. lati, cuspide solida 0·2–0·7 mm. longa. *Petala* 5, anguste obovato-spathulata, 8–10 mm. longa; limbus 3·5–5 mm. longus, 1·3–2·5 mm. latus. *Stamina* 6; filamenta linearia, 5·8–8 mm. longa, 0·1–0·3 mm. lata, inferne angustata, superne subulata; thecæ 0·8–1·4 mm. longæ. *Ovarium* 2–3 mm. longum, trimerum; stylus 5–6·5 (6·7–8: *Hatton*) mm. longus, parte communi 2·2–4·5 (5·2–6·3: *Hatton*) mm. longa, ramis tribus 1·5–2·8 mm. longis; stigmata filiformia, 0·7–1·3 mm. longa; ovula 3, rarius (*Hatton*) 4–5, 0·8–1·3 mm. longa. *Capsula* 2·8–3 mm. longa; semina 1–3, ovoidea vel pyriformia, 1·6–2 mm. longa, lævia.

VICTORIA. Murray River, *F. Mueller*!

NEW SOUTH WALES. Bourke, Oct. 1901, *F. Hatton*!

SOUTH AUSTRALIA. Vicinity of Lake Eyre, *Andrews* 22! 239!

WITHOUT LOCALITY. "New Holland," comm. *F. Mueller*! (Herb. Berol.).

The last-cited specimen is probably the same gathering as the first.

37. F. UNCINATA Sprague & Summerhayes, sp. n.—*F. lævis* F. Muell. & Tate in Trans. Roy. Soc. S. Austral. xvi, 343 (1896), partim, non L.

Caules procumbentes vel adscendentes, multiramosi, ad 20 cm. longi, internodiis ad 2·5 cm. longis. *Folia* linearia, lanceolata vel oblonga, acuta vel subacuta, rarius obtusa, 1·7–6 mm. longa, 0·7–1·8 mm. lata, marginibus revolutis ad dimidium versus costam vel ultra, supra glabra vel rarius breviter scabrido-pilosa, subtus dense papillato-puberula vel fere glabra ; petiolus 0·5–1 mm. longus. *Dichasia* pluries furcata, laxiuscula. *Bracteolæ* 0·8–4 mm. longæ, 0·5–1 mm. latæ ; petiolus 0·2–0·5 mm. longus. *Calyx* 5·7–7·5 mm. longus, 1·2–1·4 mm. diametro ; lobi ovati vel oblongo-lanceolati, acuminati, cuspidati, conduplicati, 0·7-1·3 mm. longi, basi 0·7–1 mm. lati, cuspide solida 0·2–0·3 mm. longa. *Petala* 5–6, obovato-spathulata, 8–10 mm. longa ; limbus 4–4·8 mm. longus, 2·5–3·3 mm. latus. *Stamina* 5–6 ; filamenta linearia vel lineari-filiformia, 6–9·5 mm. longa, 0·1–0·3 mm. lata, superne subulata ; thecæ 0·8–1·3 mm. longæ. *Ovarium* 1·5–2·7 mm. longum, 3–4-merum ; stylus 5–7·7 mm. longus, parte communi 3·3–6 mm. longa, ramis 3–4, 1·6–2·2 mm. longis ; stigmata breviter linearia vel clavata, 0·3–0·5 mm. longa ; ovula 3–4, 0·7–1·2 mm. longa. (Pl. 16, *d*.)

SOUTH AUSTRALIA. Ferdinand River, June 7th, 1891, *Helms*! (type). Dalhousie Springs, June 1916, *T. Gill*!

NEW SOUTH WALES. Warrego River, Oct. 1882, *Betche*! (Herb. Berol.), *E. C. Close*!

The last two records probably represent the same gathering.

38. F. HAMATA Summerhayes, sp. n.—*F. lævis* F. Muell. Ann. Rep. Govern. Bot. Victoria, 1862–3, 11 (1863), partim, non L. *F. serpyllifolia*, J. M. Black in Trans. Roy. Soc. S. Austral. xlii, 178 (1918), partim, non Lindl.

Caules ±ramosi, ramis adscendentibus vel erectis brevibus floriferis, graciles, ad 20 cm. longi, internodiis ad 2·7 cm. longis. *Folia* superiora linearia vel lineari-oblonga, inferiora lanceolata ad elliptica, obtusa vel rotundata, basi sæpe rotundata, 1·6–11 mm. longa, 0·7–4·5 mm. lata, supra glabra vel rarius præsertim versus margines sparse uncinato-pilosa, subtus dense puberula costa glabra excepta, rarius glabra, punctata ; petiolus 0·4–1·7 mm. longus ; vagina extra rarius glabra. *Dichasia* pluries furcata. *Bracteolæ* 1–4·5 mm. longæ, 0·5–2 mm. latæ ; petiolus 0·2–1·3 mm. longus, rarissime vaginæ communi bractearum adnatus. *Calyx* 7–10·2 mm. longus, 1–2 mm. diametro ; lobi lanceolati vel lanceolato-ovati, acuti vel acuminati, cuspidati, 1–2·2 mm. longi, basi 0·7–1·2 mm. lati, cuspide solida 0·2–0·5 mm. longa (0·7–0·8 : *Clarke*) conduplicati vel introrsum concavi tantum. *Petala* 5, obovato- vel flabellato-spathulata ; 10–14·3 mm. longa ; limbus 4–6·5 mm. longus, 2·2–5·5 mm. latus ; unguis angustus. *Stamina* sæpius 6, rarius 4–7 ; filamenta linearia vel raro filiformia, 6·3–11·5 mm. longa, 0·1–0·4 mm. lata, superne subulata; thecæ 1·3–1·6 (0·8–1·3 : *Andrews* 74, *Tate*, *Betche*, & no coll. Warrego River) mm. longæ. *Ovarium* 1·8–3·5 mm. longum, 0·6–0·8 mm. diametro ; stylus 6–10·3 mm. longus, parte communi 2·7–6·8 mm. longa, ramis tribus

2–4·5 (1·5: *Andrews* 74) mm. longis; stigmata linearia vel filiformia, 0·7–1·6 (0·5–0·8: *Andrews* 74) mm. longa; ovula 3, 0·5–1·5 mm. longa. *Capsula* 4·5–5 mm. longa; semina ovoideo-ellipsoidea, apiculata, 2 mm. longa, lævia.

SOUTH AUSTRALIA. Mt. Parry, Aug. 1883, *Tate*! (type in Herb. Adelaide). Peake Station, Sept. 1897, *O. E. Menzel*! (Herb. Berol.) Vicinity of L. Eyre, *Andrews* 74! Kintalakipara (Central South Australia), on flats and other salt places, *H. J. Hillier* 105! Without exact locality, 1859 (? 1860) *Stuart*!

NEW SOUTH WALES. Brindingabba, Oct. 1912, *Boorman*! Tarella, Aug. 1887, *Betche*! Warrego River, no collector! (Herb. Berol.).

QUEENSLAND. Mulligan River, western Queensland, Feb. 1904, *H. Clarke*!

This species differs chiefly from *F. uncinata* Sprague et Summerhayes in the lower leaves being unrolled, in the larger flowers, and in the longer stigmas. Further research may show that *F. hamata* is only a more luxuriant form of *F. uncinata*, but at present the evidence is not sufficient.

39. F. STUARTII Summerhayes, sp. n.—*F. lævis* F. Muell. Ann. Rep. Govern. Bot. Victoria, 1862–3, 11 (1863), partim, non L.

Caules procumbentes, pauciramosi, graciles, ad 36 cm. longi, internodiis ad 2 cm. longis. *Folia* lanceolata vel lineari-lanceolata, obtusa vel subacuta, basi angustata, 2–7·3 mm. longa, 0·5–1·5 mm. lata, utrinque sparse vel dense breviterque uncinato- vel curvato-pilosa, et subtus papillato-pilosula; petiolus 0·7–0·8 mm. longus. *Flores* ut videtur solitarii. *Calyx* 7 mm. longus, 1 mm. diametro; lobi anguste lanceolati, acuminati, cuspidati, conduplicati, 1·3–1·5 mm. longi, basi 0·6–0·8 mm. lati, cuspide solida 0·2–0·4 mm. longa. *Petala* 5. *Stamina* 6; filamenta linearia, 6–7·5 mm. longa, 0·1–0·3 mm. lata. *Ovarium* 3·7 mm. longum; stylus ultra 5 mm. longus, parte communi 3·7 mm. longa, ramis fractis ? 3; ovula 3, 1·3–1·5 mm. longa.

CENTRAL AUSTRALIA. Without definite locality, possibly Finke River, 1859 (? 1860) *Stuart*!

This plant, though incomplete florally, seems too distinct in its vegetative parts to be assigned to any of the allied species, and is therefore accorded separate specific rank. It differs from all the other species of § Uncinatæ in the densely hairy upper surface of the leaves.

§ 10. GLABRÆ.

40. F. DRUMMONDII Benth. Fl. Austral. i, 152 (1863); Ostenfeld in Dansk Bot. Arkiv, ii, 51 (1918).—*F. compacta* Ostenfeld, *l. c.* 54 (1918).

Caules ramosi, ad 23 cm. longi, sparse setuloso-pilosi vel glabri, internodiis plerumque brevissimis, sed in caule primario ad 1·7 cm. longis. *Folia* linearia vel oblonga, obtusa vel acuta interdum apiculata, ±curvata, 2·5–5 mm. longa, 0·6–1·2 mm. lata, subtus dense albido-tomentella, interdum convoluta, rubescenti-brunnea; petiolus 0·6–1·2 mm. longus, superne denticulato-ciliatus;

vagina 0·8 mm. longa, denticulata, extra glabra. *Dichasia* brevia, pauciflora. *Bracteolæ* foliis conformes, 2·5 mm. longæ, circiter 0·5 mm. latæ; petiolus 0·7 mm. longus. *Calyx* tubulosus, rubescenti-brunneus, 3·8–5·7 mm. longus, 1–1·5 mm. diametro, extra glaber, minute reticulatus, intus longiuscule adpresse pilosus vel pubescens; lobi oblongi vel lanceolati, acuti vel subacuti, 1–1·8 mm. longi, basi 0·5–1 mm. lati, conduplicati. *Petala* 5, anguste obovato-spathulata, obtusa, 8–10 mm. longa, 1·2–2·5 mm. lata. *Stamina* 6; filamenta linearia vel filiformia, 7–8 mm. longa, 0·3 mm. lata; thecæ 0·4–0·7 mm. longæ. *Ovarium* 2 mm. longum; stylus 7·5 mm. longus, parte communi 4·5 mm. longa, ramis tribus 2–3·5 mm. longis; stigmata minuta, 0·2–0·3 mm. longa; ovula 3, 0·8–0·9 mm. longa.

WESTERN AUSTRALIA. "Swan River," *Drummond* 278! (type). Wagin Lake, 1891, *Miss Cronin*! (Herb. Berol., *Diels* 7835).

Investigation indicates that the flowers in the type-specimen were not properly developed at the time of collection. If allowance is made for this, the flowers of the two specimens agree well. The Wagin Lake specimen (type-specimen of *F. compacta* Ostenf.) has on the whole less rolled-up leaves, but the older leaves are similar to those in *F. Drummondii*, and also show slightly the reddish tinge so pronounced in the type.

§ 11. GLOMERATÆ.

41. F. GEORGII Diels in Engl. Jahrb. xxxv, 389 (1904); Ostenf. in Dansk Bot. Arkiv, ii, 54 (1918).—*F. tetrapetala* F. Muell. & Tate in Trans. Roy. Soc. S. Austral. xiv, 343 (1896), partim, non Labill.

Caules superne ramosi, ad 22 cm. longi, ut rami juventute pilis curvatis vel uncinatis ± induti, demum glabri, internodiis ad 1·5 cm. longis. *Folia* obtusa, 2–5·5 mm. longa, 0·5 0·8 mm. lata, supra glabra vel sparsissime pilosula, punctata, subtus puberula vel pubescentia; petiolus 0·4–0·7 mm. longus; vagina extra glabra. *Dichasia* bis vel ter furcata, floribus 3–5 supremis sæpe confertis. *Bracteæ* et *bracteolæ* petiolatæ, lineares et fere teretes, subacutæ vel obtusæ, 1 2·5 mm. longæ, 0·5–0·7 mm. latæ, supra sparse uncinato-pilosæ, ciliolatæ, subtus dense pubescentes; petiolus circiter 1 mm. longus, applanatus, alatus. *Calyx* 4·5–5 mm. longus, 1–1·2 mm. diametro, 5-costatus, extra præsertim superne breviter curvato- vel uncinato-pilosus, intus glaber vel minute puberulus; lobi lanceolati vel oblongo-lanceolati, acuti, conduplicati, 1–1·8 mm. longi, basi 0·4–0·7 mm. lati. *Petala* 5, ligulato-spathulata, 8·3–8·7 mm. longa, 1·25 mm. lata. *Stamina* 4; filamenta superne ±falcata, 7–8 mm. longa, medio 0·2–0·4 mm. lata, inferne filiformia, versus apicem subulata; thecæ 0·7–0·9 mm. longæ. *Ovarium* 1·3–1·5 mm. longum; styli rami 2, brevissimi; stigmata minuta, haud capitata; ovula 2, 0·5–0·8 mm. longa.

WESTERN AUSTRALIA. Murrin Murrin, 1902, *W. J. George*! (type in Herb. Berol.). Southern Cross, margin of salt-lake, Nov. 1891, *Helms*!

F. Georgii seems to be closely related to *F. setosa* Fitzgerald, with which it agrees in many respects. It may be a less advanced member of the series, in which aggregation of the flowers has not yet been completed; on the other hand, it may simply be an abnormal form of *F. setosa*, but in the present state of our knowledge the species are best kept separate.

42. F. SETOSA W. V. Fitzgerald in Journ. West. Austral. Nat. Hist. Soc. i, 3 (1904); Ostenfeld in Dansk Bot. Arkiv, ii, 53 (1918).—*F. lævis* F. Muell. & Tate in Trans. Roy. Soc. S. Austral. xvi, 343 (1896), partim, non L.

Caules pauciramosi, ad 20 cm. longi, ut rami primum densiuscule patentim setuloso- vel curvato-pubescentes, deinde glabri, internodiis ad 1·8 cm. longis. *Folia* obtusa vel rotundata, 3·5–7 mm. longa, 0·5–1 mm. lata, supra glabra vel sparse breviter scabrido- vel curvato-pilosula, glandulis valde punctata, subtus dense albido-pubescentia; petiolus 0·5–1·3 mm. longus; vagina extra pubescens vel glabrescens. *Dichasia* capituliformia circiter 7-flora ad apices ramulorum corymbose disposita. *Bracteæ* et *bracteolæ* foliis similes sed magis pilosæ et longius petiolatæ, lamina bracteolarum varie reducta vel deficiente, 1–5·3 mm. longæ, 0·3–0·8 mm. latæ, supra longe patentim pilosæ, subtus pubescentes; petiolus 0·5–1·7 mm longus. *Calyx* 5 (in typo) -7·5 mm. longus, 1–1·5 mm. diametro, 5-costatus, extra costis superne longiuscule patentim setuloso-pilosis inferne glabris, inter costas puberulus, intus glaber; lobi lanceolati vel oblongo-lanceolati, acuti, cuspidati, 1–2·3 mm. longi, basi 0·5–1 mm. lati, cuspide solida 0·2–0·5 mm. longa, conduplicati. *Petala* 5 (raro 4), anguste oblanceolato-spathulata, sæpius 10–12 (7·5–8 in typo) mm. longa; limbus 0·8–2 mm. longus, inferne in unguem sensim angustatus. *Stamina* 4–5; filamenta 7–11·7 mm. longa, medio 0·2–0·5 mm. lata, basi per 2–5 mm. filiformia, versus apicem subulata; thecæ 1–1·4 (0·7–0·8 in typo; 0·4–0·6: *Young*) mm. longæ. *Ovarium* 1–2·5 mm. longum, dimerum; stylus 7·7–11 mm. longus, indivisus vel ramis duobus ad 1·5 mm. longis; stigmata capitata usque clavata, 0·1–0·4 (breviter linearia, 0·4–0·7: *Clarke*) mm. longa; ovula 2 (rarius 3), 1 (rarius 2) pro placenta, 0·5–1·2 mm. longa. (Pl. 16, *c*.)

WESTERN AUSTRALIA. Gwalia (near Leonora), Nov. 1903, *Fitzgerald*! (type ? in Herb. Berol.). Goongarrie, Sept. 1909, *Maiden*! 56 miles N.W. of Fraser Range, on quartz cap in salt-pan, 6th Nov. 1891, *Helms*! East of Geraldton, 1889, *Fitzgerald*! Near Mt. Churchman, *Young*! Near Warburton Range, 1916, *Clarke* 177! (Herb. Dept. Agric. W.A.). Lake Polaris, Southern Cross, Dec. 1926, *Gardner*!

43. F. GLOMERATA Turcz. in Bull. Soc. Imp. Nat. Mosc. xxvii, 2, 363 (1854); Benth. Fl. Austral. i, 151 (1863); Ostenfeld in Dansk Bot. Arkiv, ii, 52 (1918).

Caules multiramosi, ad 40 cm. longi; ramuli graciles, primum sparse breviter pilosi, deinde glabri, internodiis ad 2·3 cm. longis. *Folia* obtusa vel apiculata, 5–11·5 (3·5–8: *Diels* 5707) mm. longa, 0·5–1·3 mm. lata, supra glaberrima, subtus dense pilosula, costa subtus inconspicua pilis paucis longioribus vestita;

petiolus 0·3–1·5 mm. longus ; vagina extra glabra vel raro sparse puberula. *Dichasia* capituliformia, ad 1·5 cm. diametro, ad 17-flora. *Bracteæ* et *bracteolæ* foliis similes sed longius petiolatæ, bracteolæ sæpe ad petiolam reductæ, ad 8 mm. longæ, 0·5–0·7 mm. latæ, sæpe supra pilis paucis debilibus instructæ ; petiolus applanatus, 1–2·8 mm. longus. *Calyx* 6–7·5 (4·5–5 : *Gregory*) mm. longus, vix 1 mm. diametro, 4–5-costatus, extra glaber vel sparsissime patentim pilosus, intus glaber vel inter costas linea pilorum instructus ; lobi lanceolati ad oblongo-ovati, acuti, 1·2–2 (0·3–0·7 : *Gregory*) mm. longi, basi 0·3–0·8 mm. lati, cuspide solida 0·2–0·3 mm. longa, conduplicati. *Petala* 4–5, anguste oblanceolato-spathulata, 7·5–12·5 mm. longa, 0·5–1·8 mm. lata. *Stamina* 3–5, sæpius 4 ; filamenta anguste linearia, 8–12·5 mm. longa, medio 0·2–0·3 mm. lata, utroque angustata ; thecæ 0·6–0·8 (1–1·2 : *Diels* 5707) mm. longæ. *Ovarium* 0·8–2 mm. longum ; stylus 7–11·5 (5–5·5 : *Gregory*) mm. longus, indivisus vel ramis duobus brevibus 0·2–0·3 mm. longis ; stigmata minuta ; ovula 2, rarius 3, 0·6–1·2 mm. longa. (Pl. **16**, *h* & *i*.)

Western Australia. "Swan River," *Drummond*, 5th coll. suppl. 79 ! (type). Cunderdin, Nov. 1903, *Fitzgerald* ! Kumminin, 1890, *Mrs. Heal* ! Northam, 1900, *J. H. Gregory* ! West of Northampton, in thick low bush on stony flats, 150 m., Nov. 1901, *Diels* 5707 ! (Herb. Berol.).

44. F. bracteata Turcz. in Bull. Soc. Imp. Nat. Mosc. xxvii, 2, 368 (1854) ; Benth. Fl. Austral. i, 150 (1863) ; Diels & Pritzel in Engl. Bot. Jahrb. xxxv, 389 (1904) ; Ostenfeld in Dansk Bot. Arkiv, ii, 52 (1918).

Caules multi, approximati, ad 15 cm. longi, primum sparse breviter pubescentes, rubro-brunnei, deinde glabri, internodiis ad 2·5 cm. longis. *Folia* ±falcata, ex apice acuto vel obtuso apiculata, 4·8–10·5 mm. longa, 0·5–1 mm. lata, supra glabra, subtus pubescentia ; petiolus 0·5–1·5 mm. longus, persistens ; vagina extra glabra vel pubescens, post delapsum foliorum tandem deorsum fissa. *Dichasia* capituliformia, 1–2 cm. diametro, ad 20-flora. *Bracteæ* et *bracteolæ* sessiles, lanceolatæ vel elliptico-lanceolatæ, apice acutæ, versus basin angustatæ, 4–8·5 mm. longæ, 1–4 mm. latæ, marginibus præsertim superne leviter revolutis, ciliatæ, supra longiuscule sparse pilosæ, subtus costa basi longe pilosa excepta breviter pubescentes. *Calyx* 6·2–6·5 mm. longus, 1·5–2 mm. diametro, 5-costatus, extra costis præsertim superne longiuscule setuloso-pilosis, inter costas dense pubescens, intus glaber ; lobi oblongo-ovati usque lanceolati, acuti vel obtusi, 1·2–1·7 mm. longi, basi 0·8–1·3 mm. lati, conduplicati. *Petala* 5, obovato-spathulata, 9·3–11·8 mm. longa ; limbus 4–5 mm. longus, 3–3·8 mm. latus. *Stamina* 5–7 ; filamenta linearia, 5·3–9·5 mm. longa, 0·3–0·5 mm. lata, superne subulata ; thecæ 1–1·3 mm. longæ. *Ovarium* 1·7–2·2 mm. longum ; stylus 6·5–10 mm. longus, parte communi 4–7·5 mm. longa, ramis tribus 2–3·2 mm. longis ; stigmata capitata vel breviter linearia, 0·2–0·5 mm. longa ; ovula 3, 0·8–1 mm. longa. (Pl. **19**.)

WESTERN AUSTRALIA. "Swan River," 1845, *Drummond*, 3rd coll. 136 (type). Waeel, on bare, saline clayey places, 200 m., Oct. 1901, *Pritzel* 816 (*Diels* 4987 in Herb. Berol.). Cunderdin, Nov. 1903, *Fitzgerald* ! Esperance, in saline soil, Nov. 1909, *Maiden* ! (Herb. Delessert).

SPECIES INQUILINA.

45. F. PULVERULENTA L. Sp. Pl. ed. i, 332 (1753) ; DC. Prodr. i, 349 (1824) ; Benth. Fl. Austral. i, 152 (1863), in obs. ; J. M. Black in Trans. Roy. Soc. S. Austral. xlv. 15 (1921) ; Fl. S. Austral. 391 (1926).—*F. pauciflora* Maiden in Proc. Linn. Soc. N.S.W. xxviii, 697 (1904) ; Laing in Trans. N.Z. Inst. xlvii, 31 (1915) ; non DC.

Herba annua, prostrata ; caules sæpe divaricati, graciles, pauciramosi, ad 18 cm. longi, sparse pubescentes vel glabri, internodiis ad 2 cm. longi. *Folia* petiolata, lineari-oblonga ad ovata, obtusa ad emarginata, inferne angustata, 2–4 mm. longa, 0·5–1·7 mm. lata, supra glabra, subtus dense albido-puberula ; petiolus 1–1·3 mm. longus. *Flores* in dichasiis elongatis foliosis. *Bracteolæ* foliis similes, 2·2–3·7 mm. longæ, 1–1·2 mm. latæ ; petiolus 0·5–1 mm. longus. *Calyx* tubulosus, inferne paulo dilatatus, 3·5–4 mm. longus, 1–1·2 mm. diametro, 5-costatus, membranaceus, extra glaber vel costarum lateribus sparse puberulis, reticulatus, intus glaber ; lobi ovati vel triangulari-lanceolati, acuti vel acuminati, cuspidati, 0·5–1·3 mm. longi, basi 0·4–0·7 mm. lati, cuspide solida brevi 0·2–0·7 mm. longa, conduplicati. *Petala* 5, cuneato- vel ligulato-spathulata, 3·7–4·3 mm. longa ; limbus 1·3–1·7 mm. longus, 0·7–1·3 mm. latus ; unguis 0·4–0·5 mm. latus, basi subito angustatus. *Stamina* 5–6 ; filamenta inferne lanceolata vel lineari-lanceolata ; 2–3 mm. longa, paulo infra medium 0·3–0·6 mm. lata, superne subulata, versus basin angustata ; thecæ 0·2–0·3 mm. longæ. *Ovarium* 1·2–2·3 mm. longum, trimerum ; stylus 2–2·3 mm. longus, parte communi 1·2–1·5 mm. longa, ramis tribus 0·5–1 mm. longis ; stigmata lineari-clavata, 0·4–0·6 mm. longa ; ovula 34–52 (8–18 vel ultra pro placenta), 0·3–0·4 mm. longa. *Capsula* 2·3–3·7 mm. longa ; semina 37–60, ovoidea vel ovoideo-fusiformia, 0·5–0·7 mm. longa, breviter papillosa.

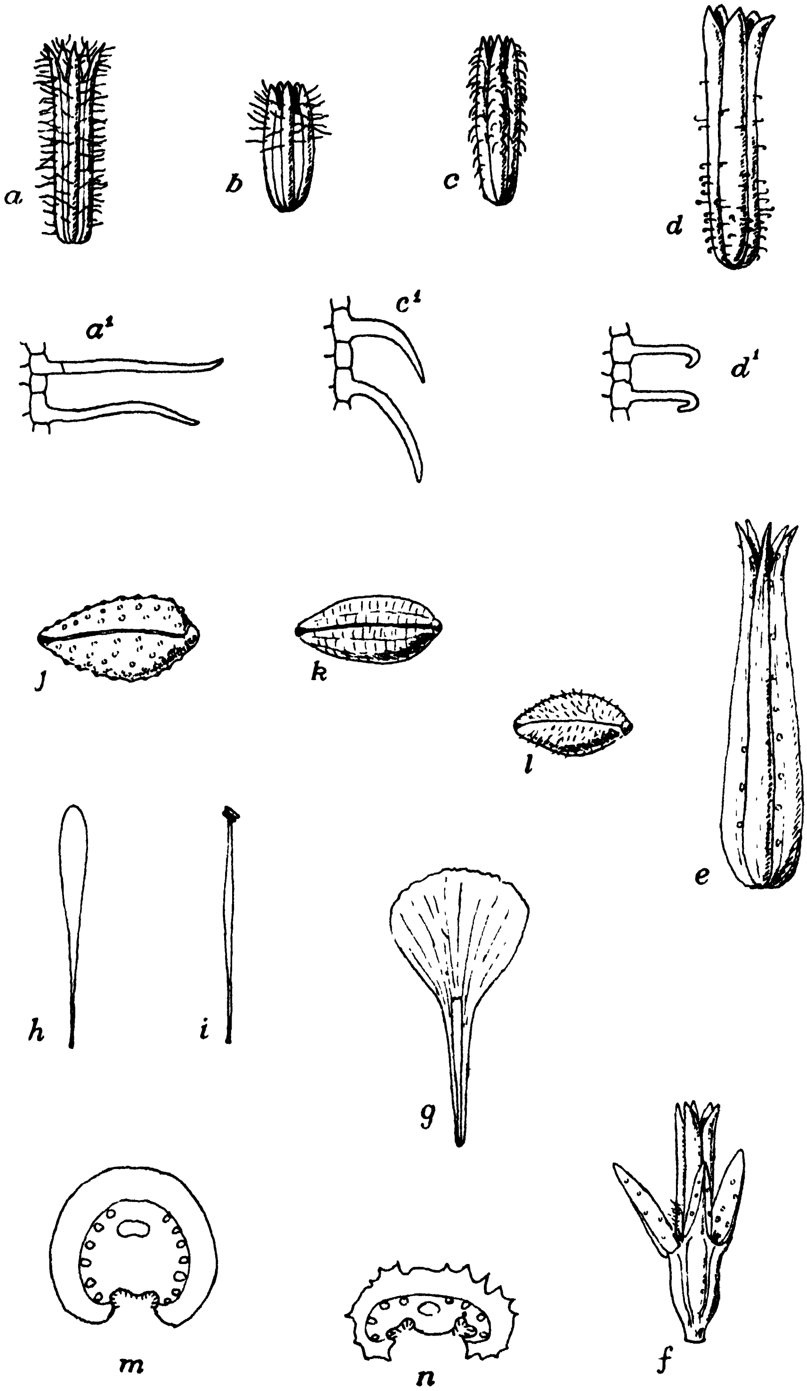
NEW SOUTH WALES. Port Jackson, 1801, *Baudin* (Herb. Paris) (not seen).

VICTORIA. Geelong, 1908, *Williamson* !

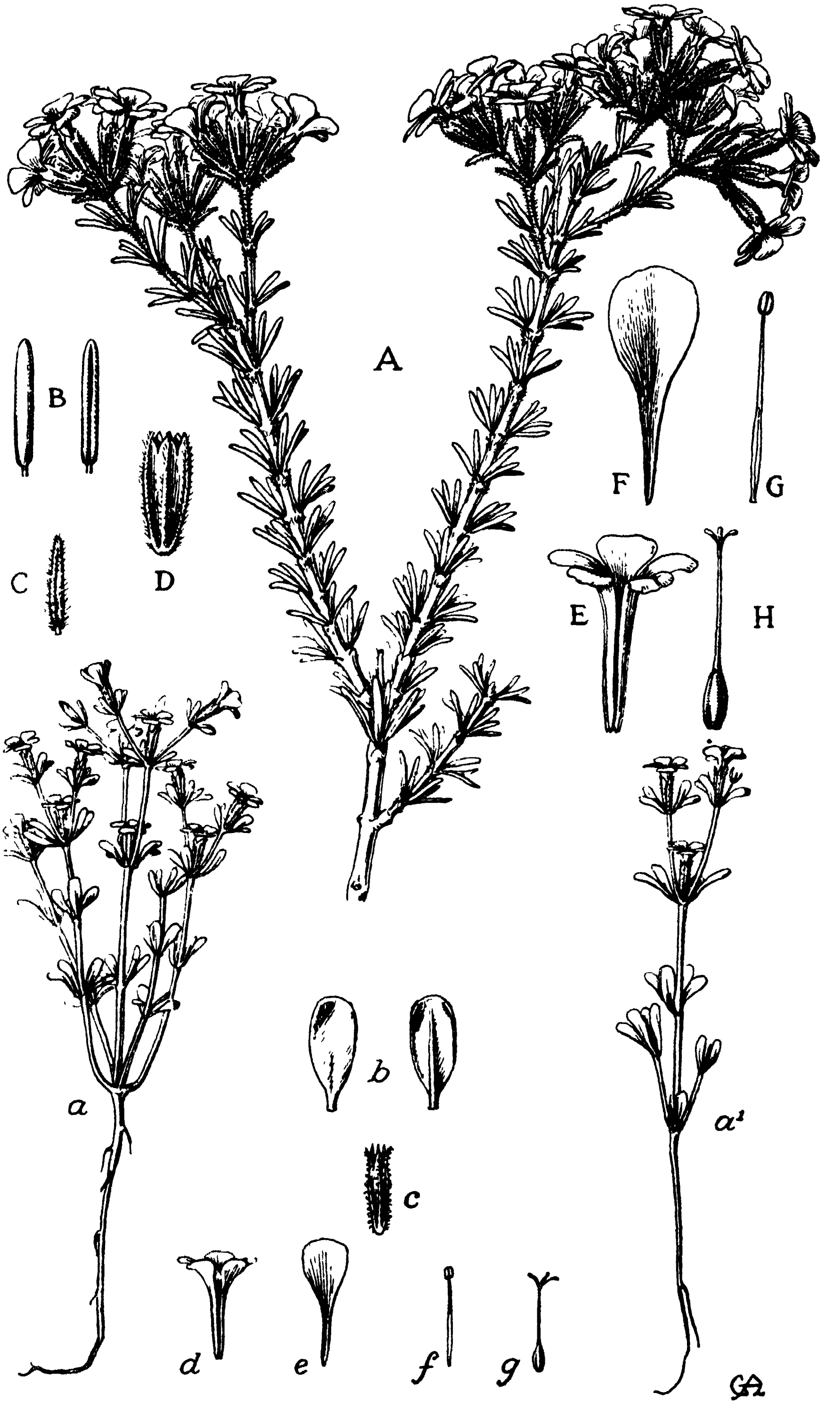
SOUTH AUSTRALIA. Port Pirie, Oct. 1901, *Koch* !

NORFOLK I. Nov. 1902, *Maiden & Boorman* !

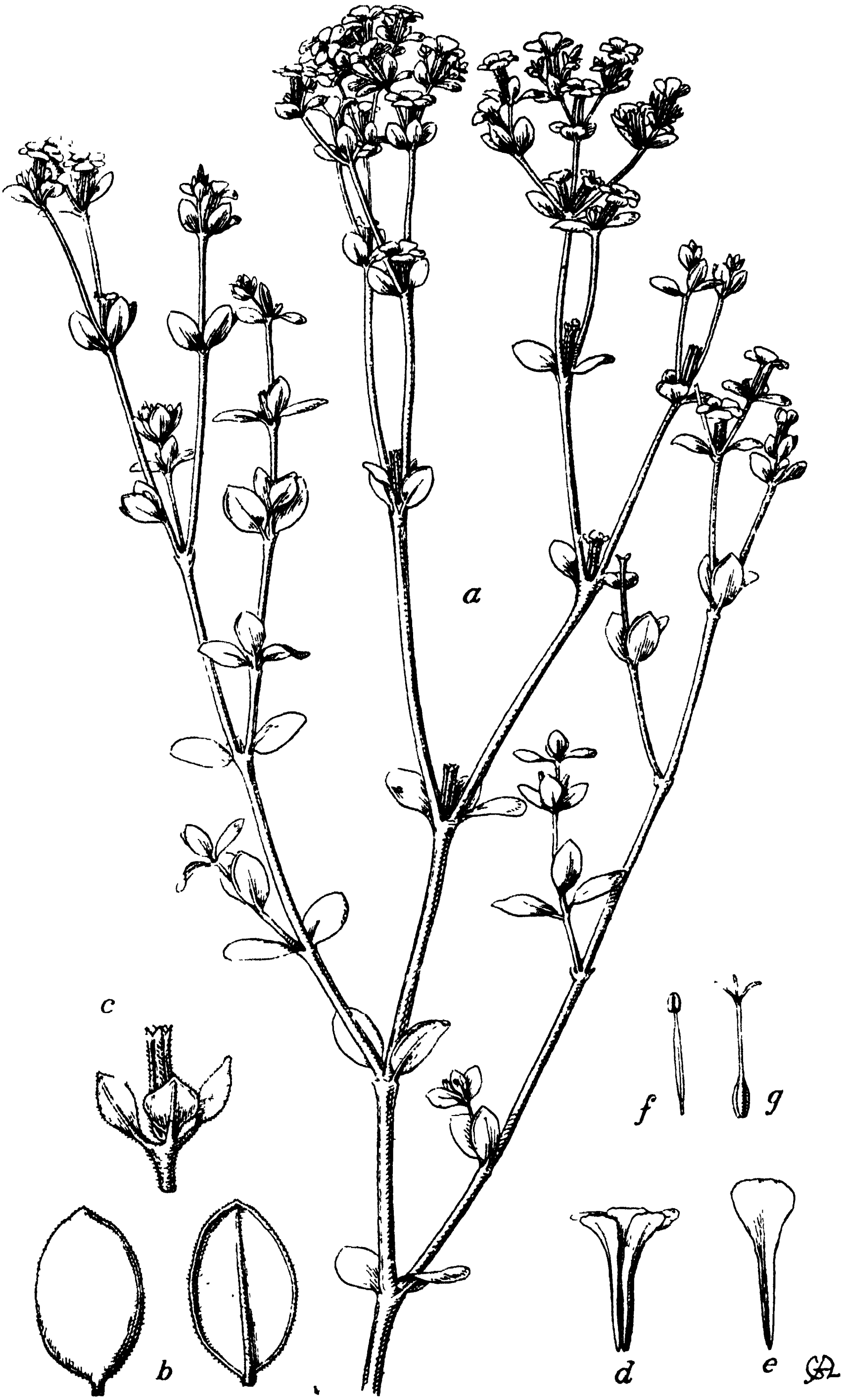
All the evidence points clearly to this species being an occasional introduction into Australia. The localities recorded are busy ports or much-frequented places, and even there the plant seems to occur sporadically. When one bears in mind the wide distribution of the species, the annual habit and the enormous seed-production, the fact that Baudin discovered it at Port Jackson so early as 1801 need cause no surprise, since Sydney was founded 13 years before. If native, it is very remarkable that it has not been found there again ; in addition, the locality is nearly 500 miles from the nearest station along the coast (Port Albert) for any *Frankenia*.



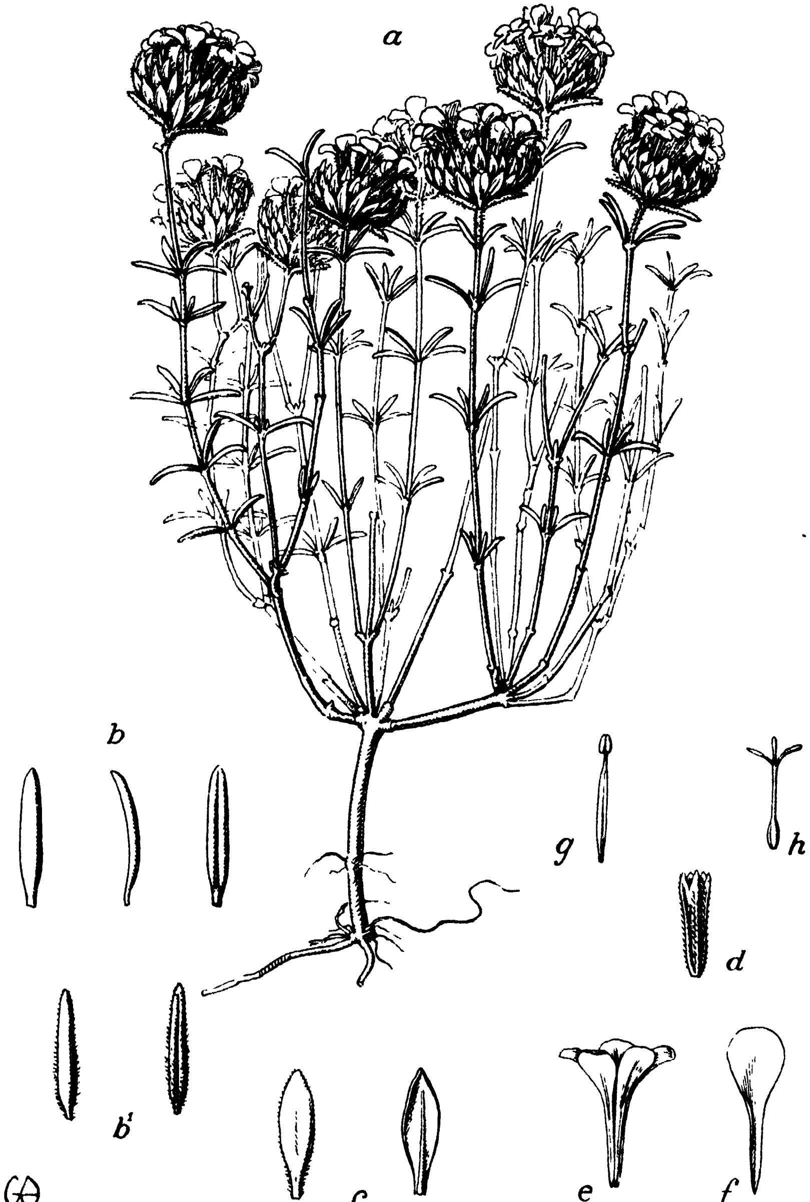
AUSTRALIAN SPECIES OF FRANKENIA.



FRANKENIA MAGNIFICA Summerh.
FRANKENIA ANNUA Summerh.



FRANKENIA PLANIFOLIA Summerh



FRANKENIA BRACTEATA Summerh.

EXPLANATION OF THE PLATES.

(All drawings were made from type or type-number specimens unless otherwise stated.)

PLATE 16.

a. *F. serpyllifolia* Lindl., calyx, × 4; *a*[1]. hairs from same, × 30. *b*. *F. parvula* Turcz., calyx, × 4. *c*. *F. setosa* W. V. Fitzg., calyx, × 4; *c*[1]. hairs from same, × 30. *d*. *F. uncinata* Sprague & Summerh., calyx, × 4; *d*[1]. hairs from same, × 30. *e*. *F. laxiflora*, Summerh., calyx, × 4. *f*. *F. ambita* Ostenf., calyx and bracteal sheath, × 4. *g*. *F. connata* Sprague, petal, × 3. *h*, *i*. *F. glomerata* Turcz., petal and stamen, both × 3 (drawn from *Fitzgerald*, Cundredin). *j*. *F. pauciflora* DC., var. *fruticulosa* Summerh., seed, × 15 (drawn from *Verco & Tarr*). *k*. *F. pauciflora* DC., var. *longifolia* Summerh., seed, × 15 (drawn from *Stoward* 78). *l*. *F. confusa* Summerh., seed, × 15. *m*. *F. subteres* Summerh., transverse section of leaf, × 20. *n*. *F. fecunda* Summerh., transverse section of leaf, × 20.

PLATE 17.

F. magnifica Summerh. A. Flowering branch, natural size. B. Upper and lower surfaces of leaf. C. Bract (or bracteole). D. Calyx. E. Corolla. F. Petal. G. Stamen. H. Ovary.

F. annua Summerh. *a.a*. Flowering plants, natural size. *b*. Leaf from above and below. *c*. Calyx. *d*. Corolla. *e*. A single petal. *f*. Stamen. *g*. Ovary.

All but A, *a*, × 2.

PLATE 18.

F. planifolia Sprague & Summerh. *a*. Flowering branch, natural size. *b*. Leaf, showing upper and lower surfaces. *c*. Calyx, bracts and bracteoles. *d*. Corolla. *e*. A single petal. *f*. Stamen. *g* Ovary. All but *a*, × 2.

PLATE 19.

F. bracteata Turcz. *a*. Flowering plant, natural size. *b*. Leaves; *b*[1]. Lowest bracts. *c*. Upper bracts and bracteoles. *d*. Calyx. *e*. Corolla. *f*. Petal. *g*. Stamen. *h*. Ovary. All but *a*, × 2. (Drawn from *Pritzel* 816.)

Further Observations on the Cuticle Structure of Mesozoic Cycadean Fronds.

By H. HAMSHAW THOMAS, M.B.E., Sc.D., F.L.S., F.G.S.

(PLATES **20** & **21**, and Text-figs. 1–13.)

[Read 15th November, 1928.]

INTRODUCTION.

In 1913 the author, in conjunction with Dr. Nellie Bancroft, undertook the examination of the cuticles of a number of fronds belonging to different genera and species of recent Cycads and also those of several types of fossil fronds, which, on account of their external form, were generally regarded as having Cycadean affinities (Thomas & Bancroft, 1913). This work was carried out with the object of determining the value of cuticle structure in the identification and classification of fossil fronds, for many unconnected observations had been previously made on cuticle structure, and many fronds were known from Mesozoic rocks whose systematic position was very uncertain. This work showed that the study of cuticle structure might provide a means of discriminating between closely allied species in a genus, and might also enable us to delimit certain genera from others which were very similar in the shape of their fronds.

The fossil forms were found to be divisible into two classes on the basis of their cuticle structure. In one class the cuticles were uniformly characterised by sinuous cell-outlines and by stomata which were level with the surface and showed the remains of thickenings of a fairly constant type. These forms were regarded as members of the Bennettitales. In the other class the cuticles did not possess such a uniform structure, the cell-walls were straight, and the stomata were usually sunken below the level of the surface being more or less covered by overarching subsidiary cells. This class was called the Nilssoniales and was regarded as more closely allied to the recent Cycads.

The fossil forms studied were all derived from the Estuarine rocks of Yorkshire, and it thus seemed uncertain that the results were of more than local significance. It is well known that the cuticle structure in recent plants varies to some extent with the habitat conditions, and it seemed desirable to extend the investigation to fronds from other localities and horizons.

The present communication is a continuation of this work. It owes its inception to a kind offer made by Prof. R. Zeiller shortly before his death, by which a collection of cuticle preparations made by this famous palæobotanist was handed over to me for examination and description. A study of this material was made in Paris in 1914, a few weeks before the outbreak of war, and much of this paper is derived from the notes then made.

The collection of material which Zeiller had made was of great interest because it was mainly derived from Central European rocks of Liassic age; it also contained specimens of some genera of Cycad-like form which I had not previously examined, while specimens from Greenland and Portugal were also present. Here, then, was an opportunity of testing the conclusions which had been reached from the study of the English material, and also of investigating the relation of some further genera to those already studied.

There were, however, certain difficulties which detract from the value of some of the observations given below. At the time when the work was done Prof. Zeiller was confined to his room by the illness which terminated fatally, and I had no means of discovering the specimens from which the cuticle preparations had been made. Several specimens were found in the collections of the Ecole des Mines which bore the same names and localities as the preparations, and which were almost certainly the examples from which the preparations had been derived, but the sources of other material could not be discovered, and we have to rely on the labels which the slides bore. However, with few exceptions, we can be quite sure of the plants with which we are dealing, for Zeiller had made and labelled the preparations himself, and he was undoubtedly an expert in the determination of Mesozoic plants. Some of the names which he gave have been changed in consequence of recent research, but where this has been done I have also given the names which Zeiller had written on his preparations.

In addition to the Paris preparations, I have also studied the cuticles of specimens from other sources.

DESCRIPTION.

The preparations to be described fall into two groups. The first contains cuticles of the type which has been regarded as typical of the Bennettitales, while the second contains the Pterophyllums whose position has to be discussed.

1. BENNETTITALES.

PTILOPHYLLUM IMBRICATUM (Ett.) Krass.

Ettingshausen in Abh. geol. Rchs. Anst. Wien, i, Abt. 3, nr. 3, p. 7, pl. i, fig. 1, 1852.

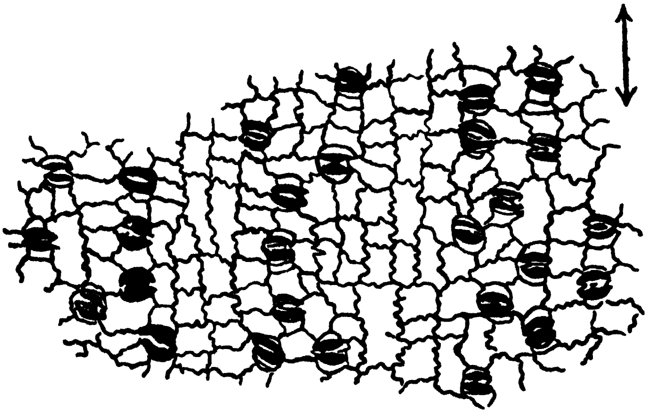
This species was described by Ettingshausen as a *Pterophyllum*, but the form of the frond and pinnæ is clearly of the type now recognised as characteristic of the genus *Ptilophyllum*. It is named *Ptilophyllum imbricatum* in Krasser's revision of the flora (Krasser, 1922, p. 361). Schenk has briefly described some features of its cuticular structure (Schenk, 1867, p. 156).

The specimen from which Zeiller's preparations were made came from the Lias of Steierdorf, and was closely similar in external form to some examples of *Ptilophyllum pecten* (Phill.) from the Oolites of Yorkshire. The blunt pinnæ had somewhat rounded bases and were attached to the upper side of the rachis with their bases closely approximated. Their cuticle structure, which shows that they are distinct from the English species, may be described as follows :—

Upper cuticle composed of more or less rectangular cells with very sinuous walls, stomata absent.

Lower cuticle (text-fig. 1) showing larger cells, which are thin-walled and much less sinuous than those of the upper side. Folds fewer and some walls almost straight. Stomata in lines between the veins, with regular transverse orientation (the pore at right angles to the long axis of the pinna).

TEXT-FIG. 1.

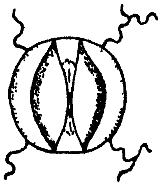


Ptilophyllum imbricatum (Ett.). Part of the lower epidermis, showing arrangement of the stomata. From a photograph. × 86.

The double arrow in this and subsequent figures represents the direction of the long axis of the pinna from which the cuticle was taken.

Stomata with small subsidiary cells which are sometimes slightly thickened (text-fig. 2). Guard-cells with spindle-shaped thickenings, darker on outer sides away from the pore. Ends of the thickenings pointed and joined by a cross-wall at each pole. Pore extending to these walls.

TEXT-FIG. 2.



Drawing of a stoma of *Ptilophyllum imbricatum* (Ett.) Krass. × 260.

When compared with the cuticles of the English Middle Jurassic species *Ptilophyllum pecten* (Phill.), we find considerable similarity in the sinuous cell-outlines, in the distribution of the stomata, and in the occurrence of small subsidiary cells. But the undulations of the cell-walls of the upper epidermis are not so deep or thick as in the English species, while the shape and extent of the guard-cell thickenings is also distinctly different. These differences are of the same order as those found between similar pairs of species in other genera, and may be regarded as ample justification for the separation of this Liassic form from the *P. pecten* type.

PTILOPHYLLUM RIGIDUM (Andrae) Krass.

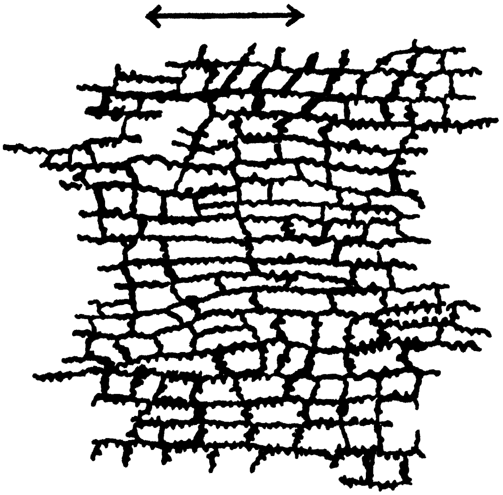
Pterophyllum rigidum Andrae, Abh. geol. Rchs. Anst. Wien, Bd. 2, Abt. 3, nr. 4 1854, p 42.

Prof. Zeiller gave Schimper's name of *Dioonites rigidus* to several specimens from the Lias of Steierdorf which seem identical with those described by Andrae and which have been subsequently transferred by Krasser (1922) to the genus *Ptilophyllum*. This generic designation seems to be correct, both from the consideration of their external features and from their cuticle structure. The pinnæ of the Paris specimens were attached to the upper side of the rachis and had an elongated linear form, tapering to a fine point. Their bases were rounded, but showed a marked tendency to become decurrent on both sides. They had a series of fine parallel veins.

When we examine the structure of the cuticles we find :—

Upper cuticle (text-fig. 3) composed of rectangular cells with sinuous walls.

TEXT-FIG. 3.



Ptilophyllum rigidum (Andrae) Krass. Part of upper epidermis. From a photograph. × 110.

The walls appear as if possessing a series of swellings owing to the undulations being developed in a plane below the surface. Stomata absent.

Lower cuticle composed of cells with thin sinuous walls, stomata occur between the veins with transverse orientation.

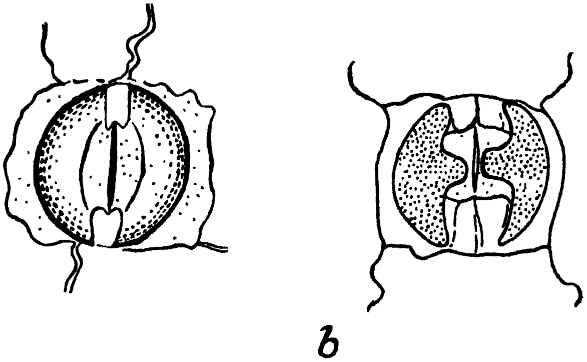
Stomata with small subsidiary cells which are partly or mainly covered by the thickenings of the guard-cells and are somewhat thickened (text-fig. 4 *a*).

Guard-cells rather short and broad, some with semicircular thickenings appearing darker towards the periphery, others show distinct upper and lower thickenings (text-fig. 4 *b*); the upper thickenings possessing projecting pegs which almost reach the pore, while the lower thickenings are small and inconspicuous. Ends of thickenings pointed or blunt. Pore shorter than in *P. imbricatum*.

This species comes very near *P. pecten* Phill. in the form of some of its stomata, but the epidermal cell-walls are very different in appearance.

In discarding the name *Dioonites* as applied to this species, the question naturally arises as to the cuticle structure of the other species which have been placed by various authors in this somewhat ill-defined genus. Unfortunately, Schenk's description (Schenk, 1871, pl. xv, text-figs. 2–4) and figures of the cuticles of *Dioonites Dunkerianus* (Goepp.) are not very precise, and no comparison can be made from them. It may then be of interest to record here the results of a study of a rare Yorkshire Jurassic form which was for some time known as *Dioonites Nathorsti* Seward.

TEXT-FIG. 4.



Stomata of *Ptilophyllum rigidum* (Andrae) Krass. *a*. With usual type of thickenings. *b*. With outer thickenings projecting towards the pore. × about 350.

LEPTOPTEROPHYLLUM NATHORSTI (Seward), gen. nov.

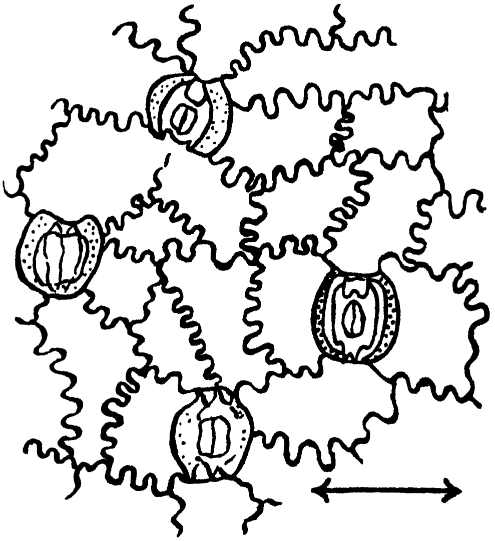
Dioonites Nathorsti Seward, 1900, Jurassic Flora, i, p. 239.
Pterophyllum Nathorsti Seward, 1911, Trans. R. S. Edin. p. 694.

Fronds of the true *Pterophyllum* type are very rare in the Jurassic flora of Yorkshire. In Prof. Seward's catalogue a single specimen was described as the type of a new species *Dioonites Nathorsti*, and, in the course of many years collecting, I have found only one other specimen. This occurred in the Gristhorpe bed and was fortunately well preserved; it has furnished some interesting cuticle preparations.

The original specimen (Pl. 21, fig. 1) was examined by Nathorst, who noted that it was "a new species belonging to some genus allied to *Pterophyllum*." Seward described it and placed it in the genus *Dioonites*. Subsequently he found other forms in Sutherland which seemed identical with the Yorkshire species, and in describing them he substituted the name of *Pterophyllum* for *Dioonites*. The name *Pterophyllum Nathorsti* has, however, been previously employed by Schenk (1883, p. 261, pl. liii, figs. 5, 7) for a species which is probably quite distinct from this form.

The new specimen (Pl. 21, fig. 2) shows a small part of a frond, and the pinnæ are seen on one side of the rachis only. Parts of six pinnæ are seen, but none of their tips are preserved. They were 3–4 mm. broad and more than 55 mm. long, through most of their length they have parallel sides, tapering somewhat above, while they expand somewhat on both sides at the base. Adjacent pinnæ are about 2 mm. apart, but their bases are contiguous. Their preservation is very perfect, and each is seen to be traversed by six to eight prominent and rather coarse veins. These run parallel to each other, but in three cases pairs of veins diverge from common points at the base, as often seen in *Tæniopteris vittata* and *Anomozamites Nilssoni*, while in two cases veins are seen to fork at a distance of about 1 cm. from the base. The rachis is not completely seen. It appears as a well-defined structure about 1·5 mm. broad with transverse striations, while in the original type the rachis, which is seen from below, is 5 mm. broad and is smooth. This probably indicates that the pinnæ were inserted on the upper side of the rachis along two lines 1·5 mm. apart, and that the median strip of rachis was striated while the remainder was smooth.

TEXT-FIG. 5.



Cuticle with stomata of *Leptopterophyllum Nathorsti* (Sew.) Thom. × 210.

There can be no doubt that this specimen is identical with the type of the species, but it is uncertain if it can be safely compared with the smaller specimens from Sutherland figured by Seward (1911, pl. iv, fig. 61, and text-fig. 13, A, B). There is also little, if anything, to separate it from a true *Pterophyllum* in its external form. When, however, we examine the structure of the cuticles, we find features which are very distinct from those in any species of *Pterophyllum* yet known and which are unique among the cuticles examined.

The remains of the pinnæ can be readily removed from the rock, and after the usual treatment with macerating fluid only one cuticle is left. By watching closely the process of solution under the microscope it is seen that the cuticle from one side of the pinnæ was extremely thin and delicate, and disappears almost completely in the process of clearing, while on the opposite side of the leaf there was a much stouter cuticle containing numerous stomata. We cannot ascertain whether the stomata were on the upper or the lower side of the leaf, but no stomata were observed on the delicate cuticle. It is possible that the stomata were as usual on the lower surface, but it is exceptional for the lower cuticle to be thicker than the upper one, and this suggests an anomalous mode of growth of the original leaf.

The stomata-containing cuticle is somewhat fragile, but fairly large pieces were obtained (see Pl. **20**, and text-fig. 5). It may be described as follows :— Cells adjacent to the veins square or rectangular, in rows 2–3 cells broad, cells between the veins very irregular in shape. All walls very sinuous and thin, but thicker near the margin of the pinna where all the cells tend to be narrow and rectangular. No stomata seen on veins, but circular thickened patches occur, representing hair-scars or aborted stomata. Stomata somewhat irregularly scattered between veins, but generally showing a transverse orientation, rather remote (about 45 per sq. mm.) and somewhat sunken below the surface. Stomata rather large (·05 mm. in diameter). No definite relation between guard-cells and the surrounding cells. Subsidiary cells not clearly seen—probably represented by a ring of thickening which surrounds the stoma. Guard-cells lightly thickened and the form of the thickenings not clear. Outer thickenings more or less crescent-shaped, coming into contact at either end of the pore, with pointed ends terminating on the cross-walls. The pore short and bordered by a thin area.

These stomata resemble those of *Anamozamites* in their arrangement, and approach *Zamites* in the shape of their thickenings. They come near to *Ptilophyllum* in their small subsidiary cells. In almost every character these cuticles differ widely from those of the Pterophyllums that have been studied, while they cannot be closely matched with any other known forms.

It seems impossible, then, to retain this species in the genus *Pterophyllum*, and if we replace it in the genus *Dioonites*, while re-defining this type by reference to cuticle characters, considerable confusion may be caused. Halle (1927, p. 197) considers that the insertion of the pinnæ on the rachis provides one of the most important characters in the diagnosis of *Dioonites*. The present species differs completely from his definition of the genus in this respect. It seems safer, therefore, to create a new genus for its reception.

The name *Leptopterophyllum* is now proposed for a genus which may be described as follows :—Pinnate fronds of the *Pterophyllum* type, but with the pinnæ inserted on the upper side of the rachis ; pinnæ showing veins which are parallel throughout most of their course, but sometimes fork. The lamina of the pinnæ of a delicate character, having epidermal cells with sinuous walls and thin cuticles. Stomata few and distant, without regular arrangement, with small thickened subsidiary cells and guard-cells which show thickenings on one face only. Stomata occur on the surface of the lamina which has the thicker cuticle, and are probably confined to this side.

The type-specimen of the species described above has never been figured previously, but a photograph (kindly lent by Prof. Seward) of one of the two fronds seen on the specimen (Leckenby Coll. No. 222) in the Sedgwick Museum, Cambridge, is now given on Pl. 21, fig. 1.

PTILOPHYLLUM BOREALE (Heer) Sew.

Ptilophyllum boreale (Heer) Seward, Fossil Plants, 1917, iii, p. 525, fig. 597.

Zeiller's collection contained preparations labelled *Zamites speciosus* Ekkorfat. These were no doubt obtained from the material described by Heer from this locality in Greenland, and are probably of Lower Cretaceous age. Heer described a series of similar forms from this region which Prof. Seward considers to be undistinguishable as separate species, and he unites *Z. speciosus* with *Z. boreale*, placing both in the genus *Ptilophyllum* (Seward, 1917, p. 525). Halle, however, placed them in the Sub-Zamites section of the genus *Zamites* (Halle, 1913, p. 57).

The cuticles of these forms have a peculiar interest in connection with the general study of cuticle structure in the group because of the high latitude of the locality in which they grew. Though Zeiller's material was fairly well preserved, the details of the stomatal thickenings could not be clearly made out. In other features, however, the preparations were very similar to those which I made some years ago in Stockholm from specimens of *Zamites boreale* Heer, kindly placed at my disposal by Prof. Nathorst. These preparations were briefly described by Seward (1917, p. 525), but have never been figured.

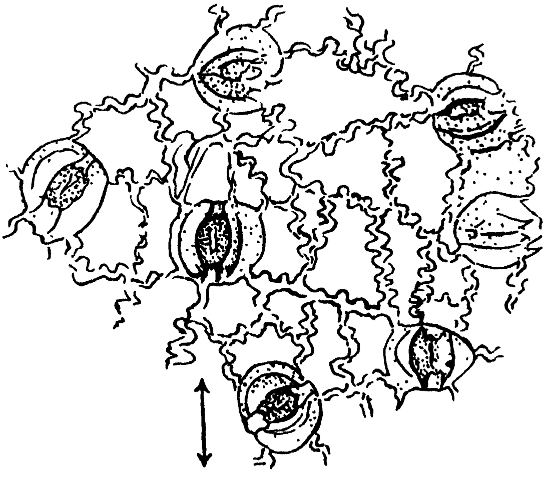
In both the Paris and the Stockholm specimens the upper cuticles were of moderate thickness and were formed from cells with very sinuous outlines. These cells were broader than long, sometimes measuring ·076 mm. across the pinna and only ·027 mm. along the pinna. On the surface of the Paris specimen were numerous small circular bodies varying in size (·08–·02 mm. in diameter) and apparently composed of cells arranged in radiating rows. Their structure could not be made out clearly, and they are probably the remains of some parasitic organism allied to the Microthyriaceæ.

Lower cuticle showing no differentiation into areas between and below the veins, cells very irregular in shape and size, their walls sinuous and rather thick. Stomata irregularly orientated and scattered sparsely over the central part of the pinnæ, being absent near the margins.

Stomata with thickened subsidiary cells, which are small or equal in width to a guard-cell (see text-fig. 6). Structure of guard-cells not very clear. Thickenings pointed at the poles and united at each end of the pore. Often the small pore is surrounded by a continuous zone of darker thickening, which in turn is enclosed in a zone of lighter thickening.

Though the stomatal thickenings are not very clearly seen, they seem dissimilar to the corresponding structures in the species of *Ptilophyllum* which I have studied, while some of these structures in the Paris specimen were comparable with *Zamites Schmiedelii* Andrae.

TEXT-FIG. 6.



Ptilophyllum boreale (Heer). From a specimen in the Stockholm Museum. Part of lower epidermis, showing scattered stomata. × 250.

It is clear that the arrangement of the stomata, which seems to be a constant and good character, is quite distinct in this species from that seen in the genus *Ptilophyllum* and also from that in the species of *Zamites* so far examined. I think it probable that Heer's species will have to be placed eventually in a distinct genus.

The main interest of these preparations, however, is that they show a close similarity with the central type of Bennettitalean cuticle, though belonging to a period much later than that of the species just described in this paper and coming from a locality far distant from Steierdorf. They agree in this respect with the cuticles of *Pterophyllum* and *Tæniopteris*, which Seward (1925, p. 241, and 1926, p. 89) has described from the same region.

OTOZAMITES RIBEIROANUS Heer.

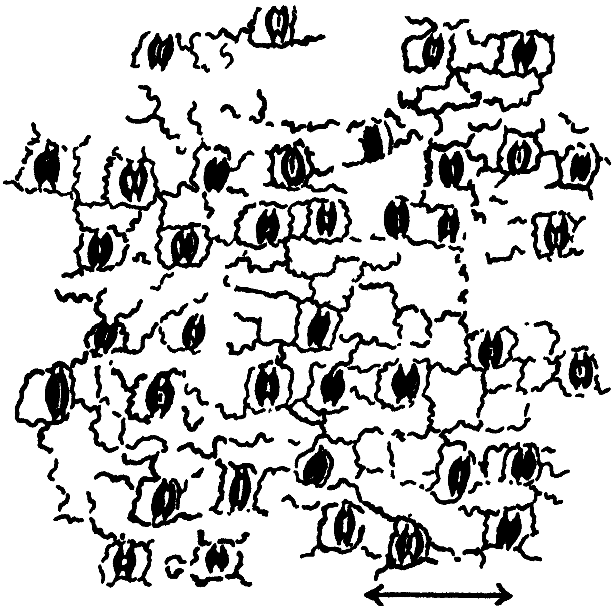
Otozamites ribeiroanus Heer, Flore foss. Portugal, 1881, p. 9, pl. ix, figs. 1-9.

This species was founded by Heer on specimens from the Jurassic beds of Cap Mondego in Portugal. Zeiller's collection contained good preparations labelled with this name and derived from the type-locality, though I was unable to find the original specimens from which they were made. The cuticle of the upper epidermis was represented in the preparations by fragments only.

The cuticles may be described as follows :—

Upper cuticle showing rectangular cells with very sinuous walls, the undulations so large and numerous that they almost touch one another and quite obscure the lumina of the cells. No stomata seen. Lower cuticle with cells varying in size, more or less rectangular, no clear distinction of the cells below the veins. All cell-walls thin and sinuous. Stomata numerous with regular transverse orientation, but not in regular rows (see text-fig. 7). Stomata with rather large, slightly thickened subsidiary cells. Thickenings of guard-cells crescentic or spindle-shaped, leaving large thin patches at the poles. Lower thickenings not well marked. Pore clearly seen, sometimes with a thickened border.

TEXT-FIG. 7.



Otozamites Ribeiroanus Heer. Part of the lower cuticle, showing the uniform distribution of the stomata. From a photograph in which the outlines of the thin-walled epidermal cells were not clearly shown. × 105.

The upper cuticle is similar to that already described for ***Ptilophyllum pecten*** (Phill.), while the guard-cells approach those of ***Otozamites Feistmanteli*** Zigno and *O. graphicus* (Leck.) (Thomas & Bancroft, 1913, p. 186, pl. xix, figs. 3, 4). The cuticular characters, as a whole, show very considerable similarity to the Yorkshire examples of the two species last mentioned.

ZAMITES SCHMIEDELII Andrae.

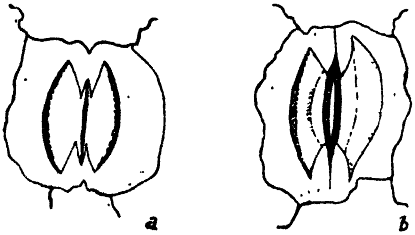
Zamites Schmiedelii Andrae, Abh. geol. Rchs. Anst. Wien, ii, Abt. 3, nr. 4, p. 39, 1854.

Zamites Schmiedelii Andrae, Schimper, Traité pal. veg. p. 152, 1870.

Zamites Andraei Stur. Verh. geol. Rchs. Anst. p. 345, 1872.

Examples of this species from the Lias of Steierdorf have given very good preparations, for which Zeiller followed Schimper's identification. The cuticle from the upper side and from the marginal parts of the lower side of the pinnæ was of considerable thickness, and it appears as though some of the subepidermal cells were cuticularised also. Both the upper and lower epidermes were composed of cells with strongly undulated walls.

TEXT-FIG. 8.

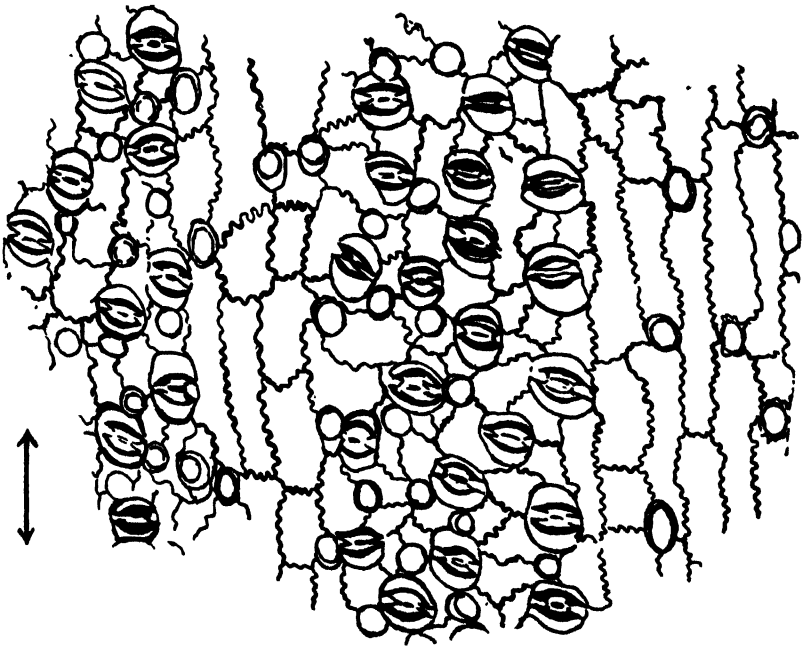


a & *b*. Subsidiary cells and guard-cell thickenings of *Otozamites Ribeiroanus* Heer. × 300.

The cuticle of the lower epidermis is rather thin (text-fig. 9), and the cells below the veins are differentiated from those between the veins. The latter were large, rectangular, and possessed strongly folded walls. Irregularly scattered, circular structures are seen both above and between the veins, which show a series of radiating striations. Some of these have the appearance of spores, but others seem to be much more like papillæ, and I regard them as the remains of papillæ or hair-scars.

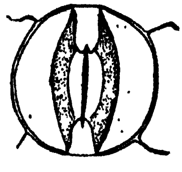
The stomata are clearly seen (text-fig. 10). They are regularly orientated at right angles to the veins, and are accompanied by subsidiary cells whose limiting walls are thick, while their surface-walls are also somewhat thickened. The guard-cells appear somewhat as in *Otozamites*, with large clear spaces at the poles and simple thickenings. The outer thickenings are crescentic, with pointed ends touching the walls of the subsidiary cells. The sides of the pore are well thickened, and are bordered by a clear space in the centre. These stomata are very similar to the Yorkshire specimens of *Zamites* which have previously been examined. Krasser (1922, p. 362), in his revision, compares the form of this species with *Zamites gigas*, to which it is without doubt nearly related.

TEXT-FIG. 9.



Zamites Schmiedelii Andrae. Part of lower cuticle, showing arrangement of the stomata and the circular papillæ-bases. From a photograph; the outlines of the walls of the epidermal cells are somewhat diagrammatic. × 102.

TEXT-FIG. 10.



Stoma of *Zamites Schmiedelii* Andrae. × about 300.

OTOZAMITES cf. MANDELSLOHI (Kurr.) Schimp.

Zamites Mandelslohi Kurr. Foss. Flor. Jura Wurttembergs, 1845, p. 10, pl. i, fig. 3.
Otozamites Mandelslohi (Kurr.) Schimper, Traité pal. veg. ii, p. 171, 1870.
Otozamites obtusus (L. & H.) Krasser, Sitz.-Ber. Akad. Wiss. Wien, Abt. 1, cxxx, p. 363, 1922.

A small specimen with blunt rectangular pinnæ having slightly auriculate bases, derived from the Lias of Steierdorf, received Schimper's name from Prof. Zeiller. The preparations made from it are not very good, but enough can be made out to show that the cuticle structure of this specimen was very similar to that of the Yorkshire species of *Otozamites*. The cells of both upper and lower epidermes had sinuous walls, stomata were absent from the upper surface and occurred between the veins on the lower side with fairly regular orientation. Few stomata are clearly seen, but when the thickenings can be made out they appear to be of a simple form, with large clear spaces at the poles. The subsidiary cells seem to be rather small.

Krasser, in his revision unites the form with *Otozamites obtusus* (L. & H.), which is found in the English Lias, but the Paris specimen was too fragmentary to allow of the formation of an opinion on this point, while the cuticle structure of *Otozamites obtusus* has yet to be studied.

Pterophyllum.

The genus *Pterophyllum* is a very comprehensive one, and includes a considerable number of fronds from different localities and from strata dating from a period between Upper Carboniferous and Lower Cretaceous times. As defined by Brongniart, the genus would include the fronds which are now universally recognised as forming the distinct group named *Nilssonia*, and even when the definition is modified, as has been proposed by Prof. Seward (1917, p. 548), a number of varied forms must still be included. It is very difficult to find any definite characters on which to rely in an attempt to further subdivide this group. I consider that a fairly distinct subdivision can be made on the character of the divisions of the lamina, as was done by Schimper, who founded the genus *Anomozamites* for the forms showing a lamina which is irregularly pinnatisect, but may be entire near apex and base. This group is considered only as a subgenus by many authors (Seward, Zeiller, Potonié), but, as I shall show later, the characters of the cuticle furnish good grounds for its separation as a distinct genus. Attempts have been made by various authors to distinguish a further class, which was given the name of *Dioonites* Miq. The original definition of this genus was not sufficiently precise, and several forms allied to *Pterophyllum* have been placed in it, though Halle (1927, p. 197) considers that the true *Dioonites* forms can be distinguished readily from *Pterophyllum* species.

There can be little doubt that this group of fronds provides a field for useful work on the cuticle structure of the various species which have been described. On the basis of cuticle structure we may not only be able to decide which species are to be regarded as distinct, but we may also be able to group the various species into well-defined subgenera, or new genera. Differences or similarities in cuticle structure may also lead to the recognition of those characters of external form which are of greater importance in classification.

According to literature, the greatest variety of forms of *Pterophyllum* is found in the Lunz beds of Austria, and a complete investigation of the cuticle structure of these forms would be valuable. As a result of a brief examination of a large number of specimens in the British Museum (Natural History) and in the

Geological Museums in Vienna, it seems clear that the specimens described by Stur from the Lunz beds are in need of a thorough revision, and it is greatly to be regretted that Dr. Fridolin Krasser who commenced this work (Krasser, 1909, p. 101) did not live to complete it.

Dr. Kräusel (1921, p. 203), however, has investigated the cuticular structure of some of the Lunz specimens in the hope of finding characters for distinguishing the closely allied species, but was unsuccessful. He described the cuticular structure of *Pterophyllum longifolium*, to which reference will be made later.

The study of the cuticles of *Pterophyllum* has also some bearing on the general systematic position and affinities of the group. In this connection various points need elucidation, among which the following may be noticed :—

(*a*) Do the typical Mesozoic Pterophyllums form a distinct class of equal value to the Bennettitales and Nilssoniales, or are they allied to one or the other of these groups ? Nathorst (1912, p. 35) suggested separating the Palæozoic and Mesozoic specimens of *Pterophyllum* into a class which was distinct in its cuticular structure from that in which *Otozamites* is typical, and which I believe to include most of the Bennettitalean forms, and he placed the *Nilssonia* species in a third class. Gothan (1921, p. 278) quotes this separation in his revised edition of Potonié's text-book, adding the chief characters on which the separation was based.

(*b*) Do the Palæozoic fronds bearing the generic name of *Pterophyllum* belong to the same group of plants as the Mesozoic forms, or may the similarity in external form be due to the homoplastic evolution of two somewhat remotely separated types of plant ? There is no need to emphasise the untrustworthiness of comparisons based solely on external shape. In the present case the real nature of the Palæozoic forms is specially interesting in connection with the question of the relation between the Mesozoic and Palæozoic floras.

During recent years a considerable amount of material has been accumulated which bears on the questions mentioned above, and the cuticle structure of a number of forms has been studied. Johansson (1922, p. 32, pl. viii, figs. 20–23) has described *P. æquale* (Brongn.) and *P. Andraeanum* Schimp. from the Rhætic of South Sweden, while Harris has described several types from the Rhætic beds of Scoresby Sound, East Greenland, viz., *P. Schenki* Zeiller, *P. Kochi* Harris, *P. subæquale* Hartz, and three other types which could not be specifically identified (Harris, 1926, pp. 88–96, figs. 16–20). Cuticles of several species of the genus *Anomozamites* have been recently described, to which reference will be made later.

In Prof. Zeiller's collection there were preparations from the Upper Palæozoic species *Pterophyllum Grand'Euryi* from Blanzy, and from *P. Fayoli* of Commentry, which had already been described by Zeiller (1906, p. 194, text-figs. B–D). There was also a poor preparation of *P. filicoides* Schl. (*P. longifolium* Brongn.) from the Trias of Neue Welt which was also figured in the same memoir. This important species was examined by Dr. Kräusel (1921, p. 203, pl. xi, figs. 1–3, text-fig. 4), but seemed worthy of re-examination, and I have obtained material from the Lunz beds through the kindness of Fraulein Adametz and the authorities of the State Natural History Museum in Vienna. I have been able to make preparations of this species and of some similar forms which have been described by several authors as distinct species, but which prove to be indistinguishable from the central type.

Zeiller's collection included preparations from Liassic specimens of Steierdorf labelled *Pterophyllum Oeynhausenianum* Goepp. and *Pterophyllum* cf. *Andraeanum*, and these are here described. The form from Yorkshire, previously classed as a *Pterophyllum* by Prof. Seward, has been described above.

PTEROPHYLLUM OEYNHAUSENIANUM Goepp.

Pterophyllum Oeynhausenianum Goepp. Jahresb. der schlesisch. Gesellsch. 1843, p. 131.

Pterophyllum Dunkerianum Andrae, Abh. geol. Rchs. Anst. Wien, ii, Abt. 3, nr. 4, p. 42, pl. xi, fig. 2, 1854.

Pterophyllum Oeynhausenianum Goepp.; Schenk. F. F. Keupers und Lias Frankens, 1867, pl. xxxviii, fig. 10.

Dioonites Bavieri (Zeiller) Krasser. Sitz. Ber. Akad. Wiss. Wien, Abt. 1, cxxx, p. 361, 1922.

Zeiller gave Goeppert's name to a small specimen and a preparation from the Lias of Steierdorf which shows interesting features.

Unfortunately, the identification of the specimen is somewhat doubtful, and Krasser in his revision of the Steierdorf flora does not mention this species. There can be little doubt that it is to be regarded as a true *Pterophyllum* on the basis of external form, and it is most closely comparable with the specimen figured by Schenk (1867, p. 165, pl. xxxviii, figs. 6, 7, 10) in his description of the Rhætic and Liassic plants of Franconia. It may be identical with the smaller forms described and figured by Andrae as *Pterophyllum Dunkerianum* Goepp., but this name cannot be used as it refers to a distinct plant.

Krasser uses the name *Dioonites Bavieri* (Zeiller) for Andrae's specimens, and, while there appears to be much similarity between the figures of the Tonkin and Steierdorf specimens, it is evident that Zeiller himself did not connect the present specimen with his Tonkin forms.

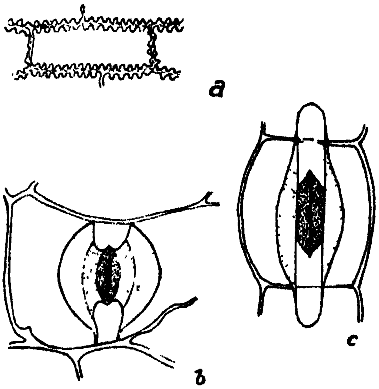
Schenk thought that *P. Oeynhausenianum* might be identical with *P Braunianum* Goepp., and. certainly the specimen in question resembles this species especially in the transversely striated rachis and the expanded bases of the pinnæ, but it is much larger and also, as we shall notice later, the cuticular structure seems to be different from that described by Schenk (1867, p. 165, pl. xxxviii, figs. 8–9). In external appearance this form approaches *Leptopterophyllum Nathorsti* from Yorkshire described above, but it is totally distinct in its cuticle structure.

A portion of one of Zeiller's preparations is shown in the photograph on Pl. 20, fig. 2, and the structure may be described as follows :—Upper cuticle formed from almost isodiametric cells, those above the veins being rectangular, the remainder rounded. Walls thick, without marked undulations, either straight and smooth, or possessing small tooth-like projections. Stomata absent.

Lower cuticle showing differentiation into areas between and below the veins. Cells below the veins almost rectangular, including no stomata. Cells between the veins rounded, including numerous stomata. Cell-walls thin, tending to be sinuous, or straight with rows of projecting points on either side (see text-fig. 11 *a*). In some places darker rounded cells occur, possibly representing bases of hairs. Stomata show a regular transverse orientation.

Stomata with large unthickened auxiliary cells, which may be longer or shorter than the guard-cells (*cf.* text-figs. 11 *b* and *c*). The auxiliary cells do not appear specialised as in the more typical Bennettitalean cuticles. Outer (upper) and inner (lower) thickenings of the guard-cells can usually be distinguished. Outer thickenings crescentic or plano-convex, sometimes projecting beyond the subsidiary cells at the poles (text-fig. 11 *c*). Inner thickenings darker and better defined than outer, from which they may be separated by a space.

TEXT-FIG. 11.



Pterophyllum Oeynhausenianum Goepp. *a*. Cell of lower epidermis, × about 180. *b*. Typical stoma, showing relation to adjacent cells, × about 400. *c*. Stoma, with guard-cell thickenings longer than subsidiary cells, × about 400.

The inner thickenings of the two guard-cells together form a sharp point at each end of the pore, beyond which is a clear polar space.

PTEROPHYLLUM sp. cf. P. ANDRAEANUM Schimp.

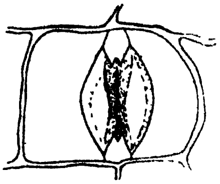
Zeiller had made preparations from a specimen from the Lias of Steierdorf bearing this name. I could not find the original specimen, which was presumably comparable to Andrae's figure of a leaf which he called *Pterophyllum longifolium* Br., and which was regarded by Schimper as distinct from Brongniart's species mainly on stratigraphical grounds. Krasser refers to the type under the name of *Dioonites Andraeanus* (Schimp.), and compares it with *Dioonites Nathorsti* Seward, If Zeiller's preparation were really made from the species figured by Andrae, we shall see that the cuticle structure is distinct from that of *P. longifolium* (=*filicoides* Sch.) from New Welt and from Lunz, so providing further justification for the foundation of Schimper's species, though showing a general agreement to other *Pterophyllum* cuticles.

The preparations show a general similarity to those of *Pterophyllum Oeynhausenianum* and *P. filicoides*, differing, however, in detail. They may be described as follows :—Upper cuticle showing uniform rectangular cells with thick walls and some slight undulations. No stomata seen.

Lower cuticle showing uniform cells with somewhat rounded outlines, walls fairly thick, straight or slightly sinuous. Stomata with regular transverse orientation, not numerous and occurring only between the veins. The occurrence of a stoma does not cause any variation in the shape or size of the neighbouring epidermal cells, since the guard-cells and subsidiary cells together occupy the same space as one ordinary epidermal cell.

Stomata with subsidiary cells which show little or no specialisation (text-fig. 12). Outer and inner thickenings not individually distinct. Outer thickenings blunt spindle-shaped, not extending as far as the cross-walls of the subsidiary cells. Area near the pore (inner thickenings ?) darker, terminating in short points. Clear spaces seen at the poles. The stomatal thickenings are similar to those of the Yorkshire *Tæniopteris vittata* Br.

TEXT-FIG. 12.



Stoma of *Pterophyllum* sp. cf. *P. Andraeanum*. × about 400.

The chief differences in epidermal structure between this form and *P. filicoides* from Lunz are :—Cuticles of both lower and upper sides thicker in the Steierdorf species, while in the Lunz species stomata often occur on the upper side, the epidermal cells are more rectangular and may be slightly papillate. The differences in the thickenings of the guard-cells are not great ; but in *P. filicoides* the pore is bounded by lighter thickenings, while in the Steierdorf plant the region of the pore is darker than the marginal part of the stoma. These differences are not great, but they are of the same order as those found between other closely allied pairs of species.

Johansson (1922, p. 34, pl. viii, figs. 22–23) has described the cuticle structure of fronds from Scania, which he refers to *P. Andraeanum* Schimp. Fronds of the same type had been previously referred by Nathorst to *P æquale* and later to *P.* sp. cf. *Andraeanum.* Johansson showed that the structure of their cuticles was distinct from that of *P. æquale,* but it also differs from the cuticles described above. In the Swedish specimens there is a marked difference between the cells adjacent to the veins and those between the veins on both surfaces of the pinnæ. The cells of the upper epidermis have walls with one or two wide folds, while those of the lower epidermis are rectangular with very sinuous walls and many papillæ. These cuticles differ in many details from the Steierdorf preparations, and in all probability Zeiller's preparations were made from a plant which was specifically distinct from that studied by Johansson.

PTEROPHYLLUM FILICOIDES (Schloth.), comb. nov.

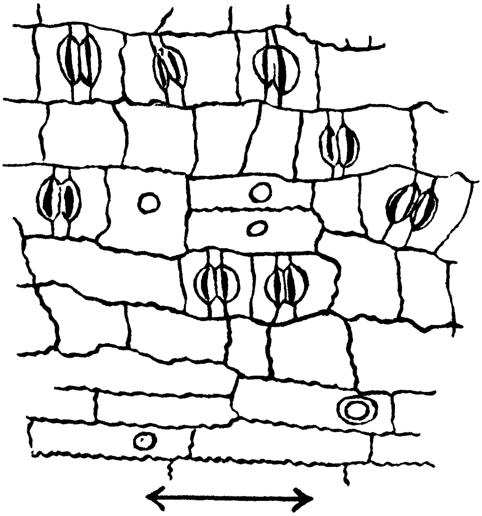
Algacites filicoides Schlotheim, in Nachtrage zur Petrefactenkunde, p. 46, pl. iv, fig. 2, 1822.
Pterophyllum Jaegeri Brongniart Prodrome, p. 95, 1828.
Pterophyllum longifolium Brongniart, Prodrome, p. 95, 1828.
Pterophyllum Jaegeri Brongn.; Schimper, Traité, p. 134, 1870.
Pterophyllum Jaegeri Brongn.; Leuthardt, Abh. Schweiz. paläont. Ges. xxx, p. 14, 1903.
Pterophyllum longifolium Brongn.; Leuthardt, *idem,* p. 16.
Pterophyllum Jaegeri Brongn.; Krasser, Jahrb. Geol. Rchs. Anst. Wien, lix, p. 117 1909.
Pterophyllum longifolium Brongn.; Krasser, *idem,* pp. 117–119.
Pterophyllum longifolium Brongn.; Kräusel, Jahrb. Preuss. Geol. Landesanst. xli, p. 203, 1921.

Zeiller (1906, p. 196, text-fig. A) published in 1906 some figures of the cuticle of the plant from Neue Weldt near Bâle, which was described by Leuthardt and other authors as *Pterophyllum longifolium* Brongn. These figures showed parts of the upper cuticle only, and by 1914 the preparations had so deteriorated that I was unable to make out any further details. In 1921 Kräusel (1921, p. 203, text-fig. 4, pl. ix, fig. 6 *b*, pl. xi, figs. 1–3) described and figured cuticles of the same species from the Lunz beds of Austria, and he stated that he had examined the cuticles of the allied species *P. Jaegeri* Br. and *P. brevipenne* Kurr., but had failed to find any distinction between the three forms. His figure of the upper epidermis differed somewhat from those of Zeiller. In connection with the present work it seemed desirable to investigate further the cuticle structure of these forms, and, through the kindness of the authorities of the State Natural History Museum in Vienna, I obtained specimens of the Lunz Pterophyllums for investigation.

Stur listed a large number of species of *Pterophyllum* as occurring in the Lunz beds (Stur, 1885, p. 99). This list was briefly revised by Krasser (1909, p. 115), who transferred some of Stur's species to other groups and divided the remainder into three sections. In his section B he includes among nine "species" the forms *longifolium, Jaegeri,* and *brevipenne,* which Leuthardt had previously distinguished in material from Neue Weldt. This author (Leuthardt, 1903, p. 14) examined in 1903 a series of forms from the locality which yielded the specimen first described by Schlotheim as *Algacites filicoides,* and reduced them to three types, which he distinguished by the "breadth index" (the length divided by the breadth) of the pinnæ. They were very similar in all other characters, and even the breadth index varied somewhat according to the size or age of the frond. This work supported the recognition of Brongniart's species *longifolium* and *Jaegeri* as distinct forms and necessitated the abandonment of Schlotheim's specific name, as it was not clear which form was shown in this early figure. Zeiller, however, adhered to the old name, and it would appear from my confirmation of Kräusel's opinion that there is no justification for the separation of the Lunz fronds into three species on breadth indices. Consequently, Brongniart's widely-used names should be dropped and the name *filicoides* used for all the forms.

From among my material I selected three specimens differing from each other in their breadth indices and in the width of the fronds. Each had the same general form, with pinnæ attached by a broad base to a stout axis, the sides of the pinnæ were almost parallel, their apices obtuse, their veins parallel, but occasionally forking. Specimen A was about 9 cm. across at a distance of 4 cms. from the apex. The breadth index of the pinnæ was 11·4 to 14. There were eight or nine fine veins in a pinna 3 mm. wide. Specimen B was of stouter build, its fronds being about 8 cm. broad, the stronger pinnæ had a breadth index of 9, with fourteen veins in a pinna 4 mm. wide; these veins appear somewhat stouter and closer than those of A. Specimen C is much smaller, only 3–4 cm. across; the pinnæ are not quite at right angles to the rachis, their breadth index is 5·3 to 7; there are eight or nine veins in pinnæ 2·8–3 mm. broad.

TEXT-FIG. 13.



Camera-lucida drawing of part of the lower cuticle of *Pterophyllum filicoides* (Schloth.). × 265.

The cuticles of these three specimens show no distinct differences; they have the same general character as those described by Kräusel, and they agree also with preparations which I have made from other fronds in the Vienna Museum and in the British Museum labelled *Pterophyllum Jaegeri* Br.

These cuticles have the following characters:—Upper cuticle shows cells of a uniform character, those lying above the veins are generally longer and narrower than the other cells, but some variation is seen in different parts of the same pinnæ. Sometimes the cells between the veins are square or rectangular, but in others they are polygonal and less regular (see Pl. **20**, figs. 4 & 5). The cell-walls are straight; they vary in thickness. In the centre of some of the cells is a small, slightly thickened spot which may represent a rudimentary papilla, but which is never so well defined as that seen in *P. æquale* (Johansson, 1922, pl. viii, fig. 21), and may be absent. A few stomata appear to be present on the upper cuticles of all the leaves examined (Pl. **20**, fig. 4). Kräusel reported that they occurred only near the margin of his specimens, but in some of my preparations they are more plentiful in the areas between the veins in the centre of the leaf. The structure and arrangement of these stomata is generally similar to that seen on the lower cuticle.

The cuticles from the lower side of the leaves are rather thin and show a marked distinction of the areas below and between the veins. The cells near the margin (Pl. **20**, fig. 5) were larger and thicker than those of the central region of the epidermis where their walls were slightly sinuous. Below the veins the cells were elongated and almost rectangular, while stomata were absent; between the veins the cells were nearly square and stomata were very abundant (text-fig. 13; Pl. **20**, figs. 3 & 5). Many of the cells on this surface possessed rounded structures on their surface-walls, probably papillæ or hair-bases. The stomata vary in number in different parts of the pinnæ. Their average distribution in areas between the veins is about 200 to the square millimetre, with variations between 140 and 230. The individual stomata are fairly constant in size, their length along the pore being about 40 μ. They show a regular transverse orientation and tend to occur in longitudinal rows, though these rows may be interrupted frequently. Each stoma with its two subsidiary cells occupies about the same area as one of the adjacent cells in the field. The subsidiary cells show no traces of thickening or specialisation. The guard-cells are but slightly thickened, and there is no clear distinction between the thickenings of the upper and lower sides; together they form spindle-shaped objects, sometimes becoming semicircular, which are shorter than the subsidiary cells and are joined to the longitudinal walls at their poles by delicate threads of cuticle. These fine threads run parallel to each other and do not meet at their junction with the adjacent wall as is shown in Kräusel's figure (Kräusel, 1921, p. 205, fig. 4). A clear space is seen at the poles between these fine threads. The stomata of the lower epidermis differ somewhat from those of the upper in appearance of the thickenings of the guard-cells. On the upper side the thickenings are almost hemispherical, as shown in Kräusel's diagrammatic figure, and the pore is clearly seen (Pl. 20, fig. 4), but on the lower side the thickenings come into contact along the pore which is seldom clearly visible, while a thin dark line or spindle-shaped patch is seen in the centre of the thickening of each guard-cell. The forms of these structures are shown in text-fig. 13.

When we compare the cuticles of the other six species of the genus which have been studied, we find that, just as in allied species of other genera, *e. g.*, the Ptilophyllums, each species shows several distinct features in the details of cell-form, stomatal thickenings, papillæ, etc. We should expect that if the three forms of these Triassic Pterophyllums were derived from three distinct species of plants they would show comparable differences in cuticle structure. But my observations agree with those of Kräusel, and show that the differences between the cuticles of fronds having different breadth indices are not more than those observable between preparations made from different parts of the same frond.

It seems safe to conclude that there are no adequate grounds for the recognition of *Pterophyllum longifolium* Br.,, *P. Jaegeri* Br., and *P. brevipenne* Kurr. as distinct species. They may be considered as forms of one species, for which Schlotheim's name *filicoides* should be employed.

Pterophyllum Grand'Euryi Sap. & Mar.

Pterophyllum Grand'Euryi Sap. & Mar.; Zeiller, Bass. Houile de Blanzy et Creusot, 1906, p. 194, pl. xlvii, figs 1, 1 *a*.

This species was founded on specimens from the upper zones of the Upper Carboniferous (Stephanian) in the coal basin of Blanzy, and has been studied in some detail by Zeiller. He was able to obtain some cuticle-preparations from both sides of the lamina and published several text-figures (Zeiller, 1906, p. 198, figs. B, B^1, C) of them in his memoir. The slides which I was able to examine contained, no doubt, the preparations from which the figures were made.

The cells of both upper and lower cuticles were more or less polygonal bounded by straight walls as shown in Zeiller's figures. The cuticles of the upper epidermis were apparently devoid of stomata, while those of the lower epidermis show considerable areas—probably those below the coarse veins—which are also without stomata. The positions of the stomata are shown in Zeiller's figures as circular shaded areas, but their details are not illustrated or described. He noticed, however, that their orientation was not regular as in *Pterophyllum filicoides* (*longifolium*).

Examination of the individual stomata shows, however, that their relation to the surrounding epidermal cells was quite different from that of the species of *Pterophyllum* described above. As indicated in Zeiller's figures, the guard-cells were apparently sunk below the level of the surface and their outlines are not visible. Above them was a small opening with five thickened subsidiary cells arranged round it in a circle. The rounded tips of these cells abutting on the stomatal cavity are strongly thickened, precisely as in *Nilssonia mediana*, and the structure is very similar to the figure of this species in my previous paper.

Zeiller considered that the epidermal characters of *P. Grand'Euryi* showed a marked affinity with those of the Triassic and Jurassic species of *Pterophyllum*, basing his comparison on his slides of *P. filicoides* and *P. Oeynhausenianum* which have been described above. Further examination, however, seems to indicate that marked differences exist. The stomatal structure is probably of much greater significance than the shape of the epidermal cells, and this, in my view, indicates the desirability of a generic separation of the Stephanian forms from the Triassic species.

PTEROPHYLLUM FAYOLI Renault.

Pterophyllum Fayoli Renault, Flor. foss. de Commentry, pt. ii, p. 619, pl. lxviii, fig. 1, 1890.

Zeiller also studied cuticle-preparations of this species coming from the Upper Carboniferous basin of Commentry, and figured some examples in which, however, no stomata are shown (Zeiller, 1906, pl. xlvii, fig. 1 *b*, text-fig. D, p. 199). He regarded the shapes and sizes of the epidermal cells as indicating a specific difference between this species and *P. Grand'Euryi*. Unfortunately, the preparations in his collection had dried up considerably and had rendered detailed examination impossible. The thin straight walls of the epidermal cells could be seen, but no stomata were visible. However, some circular dark patches were seen which might have been due to the presence of some secreted substance, or may have been stomatal cavities filled with sediment which had not been removed in the process of making the preparations.

ANOMOZAMITES Schimper.

As mentioned above, the fronds included in this group would be included in the genus *Pterophyllum* under the original definition of that genus, and are by many recent authors (Seward, 1917, p. 548) regarded as forming only a subgenus or section of the group which has been considered above. As regards external characters there is little save the shape of lamina at the apex and base of the frond which distinguishes this group, but it would appear from the present researches that the cuticle-characters furnish definite features for distinction.

There is no need for a further re-description of the cuticle-structure here. It was described for *Anomozamites Nilssoni* (Phill.) in our previous work, and since that description was published the cuticles of other species have been described. Gothan (1914, p. 44, pl. xxxvii, figs. 1–4) described and figured the cuticles of *Anomozamites gracilis* Nath. from the lower Liassic beds near Nuremberg, while Halle (1915, p. 515, pl. xiii, figs. 16–22) has briefly described and figured the same species and also *Anomozamites marginatus* (Ung.) Nath. from Palsjo in S. Sweden. Recently Seward (1925, p. 241, pl. B, fig. 14) has described briefly the structure of the cuticles of *Pterophyllum* (*Anomozamites*) *concinnum*

Heer as showing considerable similarity to those of the *Anomozamites* from Yorkshire, while Harris has described the cuticle of *A. Hartzi* Harris from E. Greenland and has re-examined *A. minor* from the same locality (Harris, 1926, pp. 80, 86, figs. 14 C, 15 A–E).

The cuticles of all these species possess very similar characters, the epidermal cells having very sinuous outlines, the stomata being rather irregularly situated and having small crescentic subsidiary cells, while the outer thickenings of the guard-cells are semicircular. Their structure shows a marked contrast with that of the species here described as belonging to the genus *Pterophyllum*, not only in the outlines of the walls of the epidermal cells, but especially in the orientation of the stomata, the shape and arrangement of the subsidiary cells, and the shape of the thickenings of the guard-cells.

The differences in the cuticle-structure between *Anomozamites Nilssoni* or *A. gracilis* and *Pterophyllum Oeynhausianum* or *P. filicoides* are of the same order or even greater than those separating species of *Ptilophyllum*, *Otozamites*, and *Tæniopteris vittata*. Differences in horizon or locality cannot now be urged as a reason for overlooking such differences as exist, and there seems to be no reason why the *Anomozamites* section of the more comprehensive genus *Pterophyllum* should not rank as a separate and independent genus.

This being so, we may now return to the question of the systematic position of the *Pterophyllum* group in the restricted sense. It seems fairly certain that some species of *Anomozamites* (fronds) were borne on plants of a Bennettitalean character (Nathorst, 1902, p. 9), but, if we regard them as distinct from the *Pterophyllum* types in the restricted sense advocated above, we have little or no evidence of the botanical affinities of the latter group. Records occur of the association of *Pterophyllum* fronds with reproductive structures of a Bennettitalean character (Krasser, 1917, p. 4), but these are not very trustworthy indications.

On the basis of cuticle structure Nathorst separated *Pterophyllum* from the *Otozamites* group, which contains the more typical Bennettitalean forms, and also from the *Nilssonia* and *Ptilozamites* groups. In my previous work two groups only, the Bennettitales and Nilssoniales, were distinguished on the basis of cuticle structure, and the present investigation strengthens the view that these two classes may be recognised by the characters of their epidermis and stomata. These were especially distinguished by the mode of occurrence of the stomata, their thickenings and subsidiary cells, as well as by the sinuous or straight outlines of the epidermal cells, though the shapes and sinuosity of the epidermal cells vary from one genus to another, and too much reliance cannot be placed on this character. Now the foregoing description shows that the Triassic and Liassic species of *Pterophyllum* possessed a fairly definite type of cuticle structure. The stomata occur between the veins and show a regular orientation ; they were not sunken, and possess subsidiary cells which are not different from the neighbouring cells. The construction of the guard-cells was, as far as can be ascertained from the remains of their thickenings, similar to that generally seen in the Bennettitales. My observations agree with Johansson's statement that in the two species which he studied the stomata possessed the type of structure typical of the Bennettiteæ (Johansson, 1922, p. 34).

The main differences separating the Pterophyllums (excluding *Anomozamites*) from the other Bennettitalean types are only the frequent absence of sinuous folding from the epidermal cell-walls and the mode of occurrence of the stomata between unspecialised subsidiary cells. But Johansson found well-marked folding in the species which he described as *Pterophyllum Andraeanum*, while Harris found the same feature in *P. Kochi* and *Pterophyllum* sp. C. cf. *P. intermedium* Antevs, from East Greenland. In the species described above there is a marked tendency towards sinuosity in the walls of the lower epidermes, and it is evident that no importance can be attached to this feature. Thus while the Pterophyllums possess characters which distinguish them sharply as a separate genus, they should take a place near *Anomozamites, Ptilophyllum, Otozamites, Dictyozamites*, etc., as members of the Bennettitales until further evidence as to their reproductive structures is available.

CONCLUSIONS.

The results of the investigation of the cuticle structure of fossil Cycad-like fronds shows that valuable information may be gained which will assist in the recognition and classification of these forms. The investigation of the cuticular structure of the rare Yorkshire species which has been called *Dioonites Nathorsti* Sew. showed that it should be placed in a distinct new genus, for which the name *Leptopterophyllum* is proposed.

There is evidence that certain characters of the epidermal cells, such as their general arrangement, the distribution of the stomata, the form of the auxiliary cells, and the thickenings of the stomata, tend to remain fairly constant in species of the same genus differing widely in time, *e. g.*, from the Lower Lias to the Middle Jurassic or even to the Lower Cretaceous, and also widely separated in space. There are no indications that the larger variations in cuticle structure are merely the results of variations in the local conditions of the environment, although it is, of course, by no means certain that the habitats of the forms described were essentially different in their ecological character.

The cuticle characters serve as a means of discriminating between species of the same genus, between allied genera, and, sometimes at least, they enable us to group together genera in a major class (family or order).

The study of the Pterophyllums shows how the cuticle varies from species to species. It indicates that the separation of these fronds in a class distinct from *Otozamites* and its allies, as was proposed by Nathorst on account of the supposed absence of sinuous walls from the epidermal cells, cannot be maintained. On the other hand, evidence is furnished for the separation of the *Pterophyllum* and the *Anomozamites* types into distinct genera, on account of the differences in the arrangement of the stomata, and the differences in the structure of both guard-cells and auxiliary cells. No clear transitional forms have been found, though *Leptopterophyllum Nathorsti* has fronds of the *Pterophyllum* form with a cuticle that approaches the species of *Anomozamites* in its structure.

Using the evidence from cuticle structure it would appear that the Upper Palæozoic fronds described by Zeiller as species of *Pterophyllum* should be separated widely from the Mesozoic forms; they appear to be more nearly related to the Mesozoic fronds of the *Nilssonia* type.

The work described in this paper raises an important problem in nomenclature, which requires the serious consideration of palæobotanists and might with advantage be discussed at some future Botanical Congress. We have shown that the study of the cuticles of *Leptopterophyllum* leads to its removal from the genus in which it would be placed by reference to external characters alone. It is probable that on the same evidence *Ptilophyllum boreale* will have to be removed from the genus *Ptilophyllum*, though in the present paper this has not been done. The same may be said for the Palæozoic species of *Pterophyllum* mentioned above. The aim of our nomenclature is to distinguish species which are separable by well-defined characters, and to group our species in genera which, as far as possible, represent natural classes. Thus, so long as cuticle structure provides definite characters, it must be used as much as possible. The problem arises as to the relative value of the characters derived from the study of external form and those derived from cuticle studies. We also have to decide whether after the definition of a genus by reference to its cuticle characters it would be allowable to refer to that genus other specimens, similar in external form, whose cuticle structure is unknown.

The recent advances in the technique of palæobotany make it clear that the future will see considerable additions to our knowledge of the cuticles of fossil plants of all ages, and some agreement on the nomenclature changes arising out of this knowledge would probably save much confusion in future publications.

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EXPLANATION OF THE PLATES.

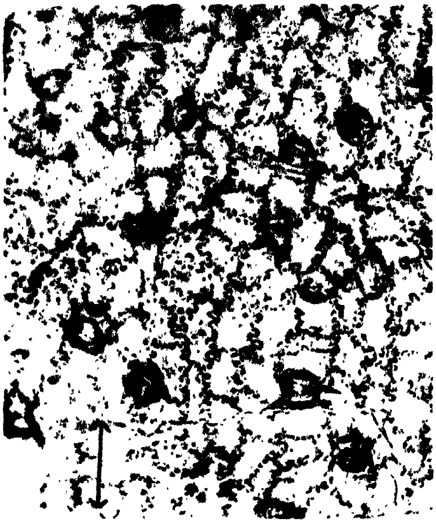
PLATE 20.

(Where the lateral margin of the pinna is not seen, the double arrow shows the direction of the pinna axis.)

Fig. 1. *Leptopterophyllum Nathorsti* (Seward). Part of lower cuticle, showing very sinuous outlines of the cells and scattered stomata. From Gristhorpe Bay, Yorkshire. × 117.

Fig. 2. *Pterophyllum Oeynhausenianum* Goepp. From Steierdorf. Cuticle from margin of pinna, showing cells of upper epidermis above and part of lower epidermis, with stomata below. × 52.

Fig. 3. *Pterophyllum filicoides* (Schloth.). From Lunz. Part of lower cuticle, showing the regular orientation of the stomata. × 117.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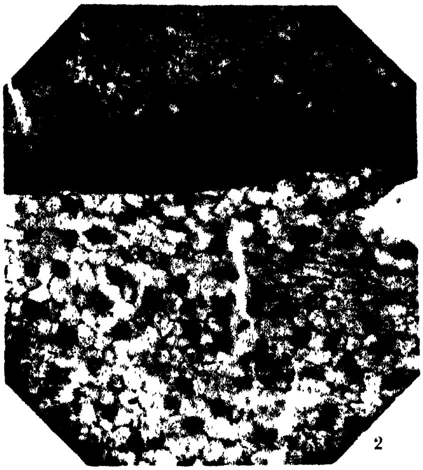
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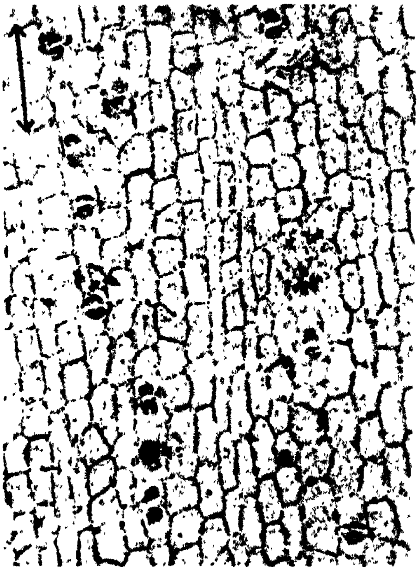
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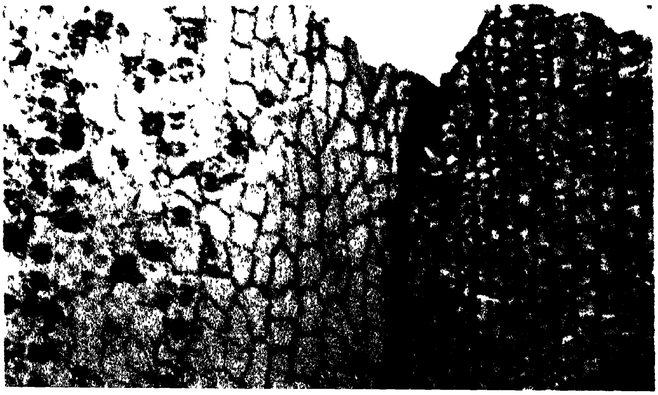
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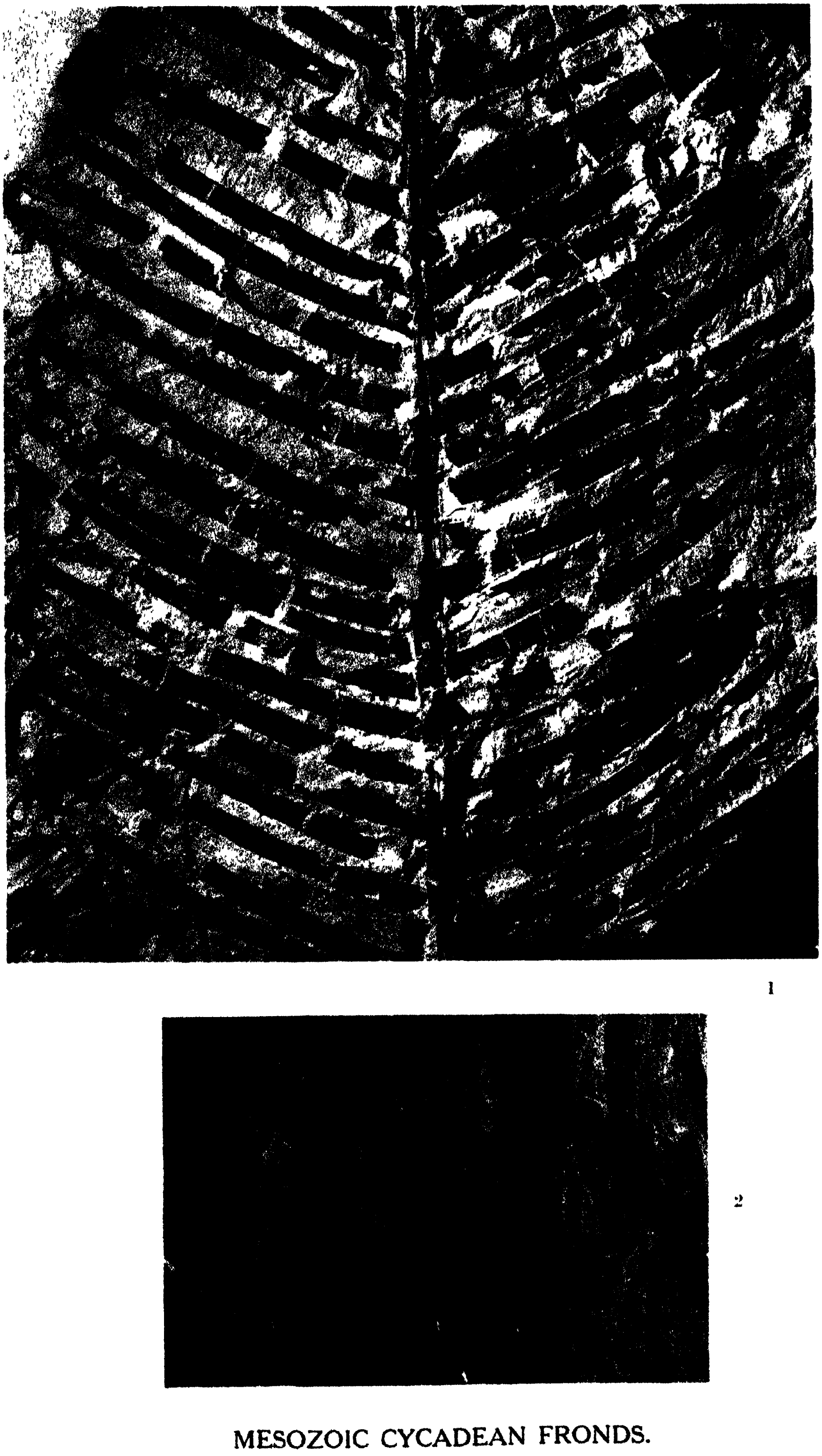

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MESOZOIC CYCADEAN FRONDS.

Fig. 4. *Pterophyllum filicoides* (Schloth.). From Lunz. Part of upper cuticle, showing shape of epidermal cells and a few of the stomata which may be present on this side. × 117.

Fig 5. *Pterophyllum filicoides* (Schloth.). Specimen C (probably=*P. brevipenne* Kurr.). From Lunz Upper and lower cuticles from margin. Some stomata are seen on lower cuticle. × 110.

PLATE 21.

Fig. 1. *Leptopterophyllum Nathorsti* (Seward). Part of type-specimen. From Lower Oolite, Yorkshire. In the Sedgwick Museum, Cambridge, Leckenby Coll. No. 222. Natural size.

Fig. 2. *Leptopterophyllum Nathorsti* (Seward). Part of specimen. From Gristhorpe Bay, Yorkshire. Showing bases of pinnæ, venation, and part of rachis × 2·8.

Biology of Wood-rotting Fungi common in Forest Areas.

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(Plates 22–25, and 1 Text-figure.)

[Read 14th February, 1929.]

Introduction.

During my investigations on hard fungi, on which I have been engaged since 1918, I have felt the necessity of an intensive study of the anatomy, cytology, and culture of some of them; as without the elucidation of various points in their biology it becomes impossible to utilize our knowledge of these fungi for the protection of timber and other useful trees.

Hard fungi (mostly Polyporaceæ) are found abundantly in forest areas. I have a good collection of them from different forests of Bengal, Behar, and Assam, and during my work in Europe I collected a number from forests round Paris and near Berlin. In this paper I have tried to bring out and discuss the biological peculiarities of the growth of twelve species in artificial cultures. I am indebted to the Royal Society of London for a grant towards the expenses of this work.

(1) *Trametes gibbosa* (Pers.) Fr.

(Tissue-culture.)

Fructifications of *Trametes gibbosa* (Pl. 22. fig. 1) are common in Europe and have been described by Rea (1922). A number of big sporophores were collected from the forest of Fontainebleau near Paris in January, 1924, on dead branches of an old *Fagus sylvatica*. It usually grows on stumps and on dead parts of beech, poplar, etc.—it is, therefore, a saprophyte. I have not been able to obtain this species in Bengal. It has been reported from Bontoc-Luzon growing on *Larix occidentalis*.

For culture work a small piece of tissue was taken aseptically from the context of a fresh sporophore, and put in tubes, sterilized in an autoclave, containing the following medium:—agar 2 per cent., sugar 5 per cent., and wood-decoction, 200 c.c. To this was added alcoholic tannin 2 gms. per litre, and tartaric acid 1 gm. per litre, according to the method of Prof. Viala. Wood-decoction was prepared by taking 30 gms. of finely powdered wood in one litre of water, boiling at 100° C. for one hour, and then filtering.

The culture work was begun on the 12th of January, 1924, in the laboratory of Prof. Viala at the Station des Recherches Viticoles, Paris. The tubes were kept at room temperature, which varied from 64° to 68° F.; growth began from the tissue on the fourth and fifth days after inoculation. A number of tubes containing the above media were kept ready, and as soon as white mycelial growth was obtained it was transferred successively from one set of tubes to the other; in this way chances of contamination were avoided.

Prof. Viala (1922) has found, in the course of his work on vine disease caused by *Fomes igniarius* and *Stereum hirsutum*, that the addition of a small quantity of alcoholic tannin (2 gms. per litre) to the media wonderfully favours the growth of hard fungi in artificial cultures; he holds that the fungus secretes a diastase, which, mixing with the tannin in the medium (or in the plant tissues in the case of parasites), converts tannin into tannic acid. The presence of tannic acid is indicated by a brownish zone, and the fungus with the help of the tannic acid kills the living tissue, and thus it always advances by a brownish zone within the tissue of the plant. I also noticed in my cultures, after growth had continued for some days, a similar browning of the white medium caused by the white growing mycelia. On the 5th February, 1924, a large number of conidia were found on the hyphæ, together with many crystals of calcium oxalate; the crystals were of two kinds, some being small and single, others large and consisting of a combination of rod-shaped crystals. Two kinds of white hyaline hyphæ were noticed, some narrow and others broad. They formed a much-branched network. By April the hyphæ were forming numerous drops of a shining liquid on their surface; the drops were first small and white, but subsequently they became larger and turned brown. On examination these drops were found to contain numerous round, white and brownish conidia—both of approximately the same size; it may be that the white conidia were later turned brown by the brownish liquid. Ultimately the brownish liquid was covered over by the white mycelium. A number of sterile tubes, containing sterilized wood-decoction gelatin media, were inoculated with small drops of this liquid, containing both brown and white conidia. In course of time, they gave rise to a white mycelium of *Trametes gibbosa* in pure culture, and the whole of the slant was soon covered with a vigorous growth.

After successive transfers, when it was found that the whole of the slants of the tubes was covered with pure white mycelial growths (Pl. 22. fig. 2), a number of large sterile flasks, containing the same sterilized medium, were inoculated with a subculture from the pure growth. These tubes and flasks with pure growths were kept within a glass chamber at the ordinary room temperature, and the fungus continued to grow satisfactorily for a number of months. In all cases of vigorous growth it was noticed that the mycelium travelled up from the medium to the glass surface. In the flasks this could be clearly seen in the form of a circular white woolly mass above the media.

Some sterilized Roux tubes, containing sterilized blocks of dead but compact wood of *Betula* in contact with water at the bottom, were inoculated with a fragment of the mycelium from one of the pure growths; in the course of two to three months the whole of the wood was covered externally by a white mass of tough and compact mycelium. I could not get any fructification from these wood-blocks, on which the fungus still persists in the vegetative condition (Pl. 22. fig. 3). They were prepared by cutting blocks of compact wood measuring four inches by half an inch from the central part of the dead stem, leaving out the outer bark; they were first plunged for some time in boiling water in a pan, and subsequently were kept immersed in cold water overnight. This process was repeated for three days consecutively; the object was to drive out air from the wood blocks and to get them water-soaked. They were next put in sterilised Roux tubes with water at the base, and the tubes were sterilized in an autoclave at 120° C. for 20 minutes. In the course of the culture work with the rest of the species described hereafter, the same process was repeated when employing blocks of dead wood of the following species:—*Tamarindus indica*, *Mangifera indica*, *Albizzia Lebbek*, *Spondias mangifera*, and *Cæsalpinia pulcherrima*.

The tubes and flasks with pure mycelial growths in wood-decoction agar media were taken by me to Calcutta. Some of these pure growths were transferred to sterile tubes containing sterilized malt-extract agar medium (agar 2 per cent., malt-extract 3 per cent., water 100 c.c.) and some to Roux tubes containing sterilized blocks of dead but compact wood of *Tamarindus indica* and *Albizzia Lebbek*, with water at the bottom. In the course of two months the whole of the upper surface became covered with a vigorous growth of snow-white mycelium, and there was an exudation of numerous white glistening drops from the hyphæ. Cultures on wood-blocks have not as yet fructified, though tiny fructifications (Pl. 22. figs. 4 & 5) appeared in two tubes, containing malt-extract agar medium, just towards the glass surface, in July 1925, after a lapse of eighteen months of repeated subcultures. The external character of the hymenial surface agrees in all essentials with that of the fructification found in nature, but the pores formed do not contain basidia; only a few spores were found, and numerous crystals of calcium oxalate. These spores were oval, with a thick wall, 6 x 4 μ, some faintly brownish, and some white. In some of the tubes pores were formed, as small depressions irregularly distributed over the surface, in the form of an elongated patch, recalling the pore-surface of the genus *Poria*; these might be regarded as abortive sporophores. In this respect I entirely agree with the observations of Baxter (1924, pp. 63–64), regarding the formation of typical pilei in artificial cultures of Polyporaceæ. During my visit to the laboratory of the Centraalbureau voor Schimmelcultures, at Baarn, in July 1924, Mlle. Westerdijk informed me that it was also her experience that sporophores formed in artificial cultures of Polypores do not contain basidia or basidiospores, but that only pores are formed, in which are found a number of conidia and conidiophores and a large mass of crystals of calcium oxalate.

In conclusion, I must express my deep sense of gratitude to Professors Viala and Marsais for extending to me facilities for working in a well-equipped laboratory and for many helpful suggestions during the course of this culture-work.

(2) *Polyporus adustus* (Willd.) Fr.

(Spore-culture.)

Polyporus adustus is common in Europe almost throughout the year. It has been described by Rea (1922, pp. 587–588). A number of good specimens were collected from the forest of Fontainebleau growing on *Fagus*, and from the forest of Corinchen, near Berlin, on stumps, in February and August 1924, respectively. Spores were white, oval, and about 5 × 2 μ.

For cytological study a piece of a fresh sporophore was fixed in Rigaud's fluid, microtome sections 5 μ thick were cut after embedding in paraffin, and they were stained with iron-hæmatoxylin, following Heidenhain's method. As a result of the study of the basidia a number of younger and much narrower basidia were found interspersed among the normal mature ones. Most of the basidia were binucleate; in some there were four nuclei, in consequence of two divisions of the fusion-nucleus. In one basidium the anaphase stage of the fusion-nucleus with the transverse spindle was quite distinct, but the number of chromosomes could not be distinctly counted.

Polyporus adustus is commonly a saprophyte, growing on dead parts of trunks, stumps, and fallen branches. Recently Brooks (1925) has reported it as a wound-parasite, causing considerable damage to apple-trees. The only previous record of it as a tree parasite (causing disease in beech-trees) is that by Prior (1913). I have not been able to get this species in Bengal; but it has been reported from Sikkim by Theissen (1911), and more recently from Sonamarg, Kashmir, at an elevation of 9000 to 12000 ft., by Stewart (1924). Apparently it occurs only at high altitudes in this country. It has a wide distribution, occurring in India, Europe, North America, Cuba, Australia, New Zealand, East and South Africa, Brazil, Patagonia, China, and Sikkim.

METHOD OF MONOSPOROUS CULTURE *.

Some good fresh sporophores of *Polyporus adustus* (Pl. 22. figs. 6 & 7) were taken direct from the field to the laboratory of Prof. H. Kniep at the Pflanzen-Physiologisches Institut in Berlin on the 11th September, 1924. On the inner surface of the upper lid of a Petri-dish, containing sterilized 10 per cent. gelatin medium, a small piece of the sporopore, which was thoroughly rinsed in sterilized distilled water, was stuck by means of melted gelatin in such a way that the porous surface remained pointing downwards above the medium when the upper lid was put in position. The Petri-dish thus arranged was kept within a bell-jar, lined over the inner surface with water-soaked blotting paper to maintain humidity. After four or five hours the Petri-dish was examined under the low power of the microscope, and it was found that a large number of spores had dropped on the medium, over an area corresponding to the porous surface of the piece of sporophore. The moist condition of the enclosed air helps a good deal in quick spore-discharge. Three sterile tubes containing sterilized 10 per cent. gelatin media were placed in a water-bath to liquefy the gelatin. By means of a platinum loop spores were then removed from the same spot of the medium to the three tubes one after another in quick succession. The tubes were sharply rotated between the palms of the hands to secure a more or less uniform mixing of the spores in the liquid media, and their contents were then quickly poured aseptically into three sterilized clean Petri-dishes. In the third Petri-dish the number of spores was few and they were wide apart. As before, the Petri-dishes were kept within a bell-jar covered inside with moist blotting-paper. In the course of two days a number of spores had germinated into primary mycelia. The position of monosporous mycelia, isolated from their neighbours, was sought out under the microscope, and each was marked by an object-marker.

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* For this method, which has been followed in all spore-cultures, I am wholly indebted to Prof. Hans Kniep, of Berlin, who was kind enough to help me with his valued advice and suggestions.

Seven such monosporous mycelia were transferred to seven sterile tubes containing malt-extract gelatin media (gelatin 10 per cent. and malt-extract 3 per cent.). After growth had advanced a little, they were subcultured to sterilized malt-extract agar media (agar 2 per cent., malt-extract 3 per cent.), seven days after their first transfer. The seven tubes with agar subcultures were taken by me to Calcutta. They were kept within a glass chamber at the ordinary room temperature, which varied from 75° to 80° F. The growth was rather rapid, and the whole of the slants became covered in the course of two months, the white hyphæ forming a number of small glistening drops. Ultimately the malt-extract agar was discoloured by the growing mycelia, the colour changing into a much paler yellowish one. A number of white round conidia were found on the hyphæ. It is generally held that conidia are usually formed in a saturated atmosphere in artificial cultures, whereas in nature this state of saturation cannot be obtained. A number of transfers from the monosporous mycelia were made, on the 25th November and the 18th December, 1924, to sterile Roux tubes, containing sterilized blocks of dead but compact wood of *Mangifera indica*, *Tamarindus indica*, and *Albizzia Lebbek* and with a little water at the constricted ends. The blocks of wood were prepared and sterilized in the same way as before (*vide supra*, p. 419). In two or three months some of these blocks became covered with a thick floccose growth of mycelium. In some the mycelium spread all round the glass surface from the wood-blocks, and in almost all it came down from the wood-blocks to the water surface. It grew luxuriantly in the watery medium, giving rise to a dense mat, floating on the water, and forming a number of glistening brownish drops on the surface. There were, however, some wood-blocks on which the mycelial growth was very poor.

In one of these blocks of dead but compact wood of *Mangifera indica*, with a poor mycelial growth, four tiny fructifications, with pilear development, were formed on the 10th May, 1925, after an interval of about eight months ;

these fructifications were situated almost in a line on one of the edges of the wood (Pl. **22**. fig. 8), but the mango-wood showed no sign of delignification. Other wood-block cultures have not as yet fructified. Out of the seven monosporous cultures, transferred on the 20th of September, 1924, in Berlin, to sterilized tubes containing malt-extract agar, three fructified here in Calcutta in February 1925 after an interval of about five months (text-fig. 1). These fructifications agreed in all essentials with those found in nature; they were, however, much smaller, and in the pores that formed, no basidia could be found, though there were spores which resembled normal spores of *Polyporus adustus*. In the pores numerous crystals of different sizes were found. Changes of colour of the hyphæ in culture were noted; at first they were snow-white, but later they changed to a pale greyish colour with a slight brownish tinge. The old cultures formed a dense mat of thickly interwoven hyphæ. In some wood-block cultures the growths completely enveloped the wood; but their action on the different kinds of wood employed was not marked, the wood had decayed very little, and the delignifying action, as shown by the tests made for lignin and cellulose, was almost nil.

(3) *Stereum hirsutum* (Willd.) Fr.

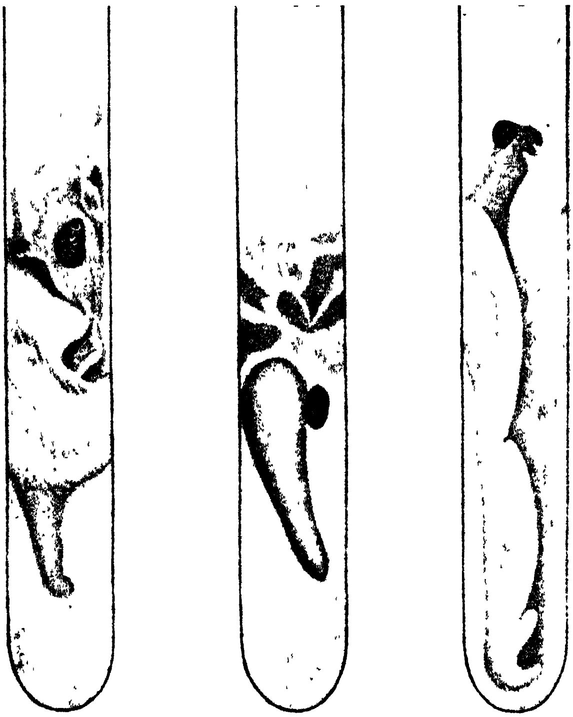
(Spore-culture.)

Stereum hirsutum (Pl. **22**. fig. 9) is a cosmopolitan species. It is found abundantly in forest areas in India as well as in Europe almost throughout the year, occurring on stumps, dead trees, logs, etc. A number of fresh sporophores was collected in Berlin in September 1924. The spore-deposit was taken on the 13th September in the laboratory of Prof. H. Kniep, following the usual method. By the 15th September a number of monosporous mycelia, which had germinated in poured agar plates, were transferred to malt-extract agar tubes. The growth at first was slow. The tubes were taken by me to my Calcutta laboratory in October. When they were unpacked, a vigorous mycelial growth was noticed in all the tubes. The hyphæ were at first white, but later acquired a yellow colour here and there, and glistening drops of liquid were formed on the surface. On the 23rd December the growths were subcultured to another set of malt-extract agar tubes. By February 1925, after an interval of about five months, some of these monosporous mycelia had fructified on the upper end of the medium in contact with the glass surface of the tubes.

On the 25th November fragments of monosporous mycelia were also transferred to sterile Roux tubes, containing sterilized blocks of dead but compact wood of *Tamarindus indica* and *Mangifera indica*, with sterile water at the base. The mycelial growth on these wood-blocks was not very vigorous and did not completelys urround the blocks. By April 1925, after an interval of about seven months, resupinate brownish-yellow patches bearing abnormal fructifications (Pl. **22**. fig. 10) had developed amongst the thick white mycelial mat on the surface of wood-blocks. I could not find basidia, though spores resembling normal spores were abundant. The wood remained intact without being affected by the mycelial growth.

The peculiarities of the mycelium of *Stereum hirsutum* in culture from the spore have been described by Cool (1912), and I entirely agree as to the details recorded by her. The discolouring of the malt-extract agar medium was noticed. In monosporous cultures a number of clamp-connections in the hyphæ were seen, showing that *Stereum hirsutum* is homothallic, and it is strange that Brefeld could not find any. In older cultures chlamydospores were very abundant, occurring at intervals as small, round, lateral swellings on the hyphæ.

TEXT-FIG. 1



Fructifications of *Polyporus adustus* in culture.

(4) *Polystictus sanguineus* Linn.

(Spore-culture.)

Polystictus sanguineus is common in Bengal, and I have (1918) published a systematic description of it. It is of common occurrence in the forest areas of the Sunderbans, Buxa Range, Duar Forest, Cachar, etc., growing as a saprophyte on stumps of *Dipterocarpus incanus*, *Hymenodictyon*, *Shorea robusta*, and various other trees, as well as on dead prostrate trunks and also on roots. The species has a very wide distribution in the tropics, but has not been found in temperate regions.

Some fresh deep red sporophores were collected from the forests of Buxa Range in April 1925. The method followed for getting the spore-deposit was the same as with *Polyporus adustus* (vide supra, p. 420). After the spores had germinated in poured plates, a number of polysporous mycelia were transferred on the 1st May to several sterile tubes containing sterilized malt-extract agar media, and the tubes were kept within a glass chamber at ordinary room temperature. The mycelium grew quickly. In the course of a week, the slants became covered with a white, cottony, pure growth. After a while there was noticed a gradual change in colour of the hyphæ from white to red. The red colour appeared in patches ; in some it was in the form of a thick line, while in others it took the form of scattered dots over almost all the exposed surface of the medium. The exudation of glistening drops of liquid was rather scanty, and the discolouring of the malt-extract agar media was not pronounced. The hyphæ bore a large number of crystals and were of two kinds—some being narrow and the others broad.

By the 1st June, *i.e.*, in the course of a month, a number of small abnormal fructifications appeared at several places on the media ; some were towards the glass surface on the upper end, others in the middle of the slant. Each tube contained three or four tiny fructifications, some of which had short lateral stalks. A compact porous surface with elongated pore-tubes was quite distinct (Pl. 23. fig. 11). The colour of the hymenial surface was reddish brown. The pore-tubes did not contain basidia, but there were spores, which were oval, white, and measured $3 \times 2\ \mu$, and many crystals. A cytological study of the basidia was made by fixing small fragments of hymenium in Fleming's strong solution ; they were finally embedded in paraffin, and microtome sections, $4\,\mu$ thick, were cut and stained with iron-hæmatoxylin. The prophase stage of the fusion-nucleus was quite clear in a large number of basidia.

(5) *Trametes cingulata* Berk.

(Spore-culture.)

Trametes cingulata is a common saprophyte here, growing on dead branches, prostrate trunks, on logs and timber, etc. ; I have (1918) published a systematic description of it.

Sporophores were collected from the forest of Buxa Range, growing on the outer bark of a dry *Hymenodictyon excelsum*, in September 1925 ; a spore deposit was taken on the 1st December, following the previous method. The spore discharge was quite copious. In some of the old and dry specimens of Polyporaceæ, I have seen, as has also been noticed by other workers, that the spore-fall can be revived by keeping the specimens in a moist condition, as, for instance, in contact with moist cotton-wool on the upper surface of the pileus. On the third day a number of spores had germinated on poured agar-plates and a number of polysporous mycelia were transferred to sterilized agar-tubes. The tubes were kept in a vertical position within a glass chamber at the ordinary room temperature. The white mycelium grew rapidly, and a number of crystals were noticed on the hyphæ. There was no change of colour in the old hyphæ, but the mycelium coloured the white medium brown, showing brownish tips towards the glass surface.

Small fructifications (Pl. 23. figs. 12 & 13) were formed in two out of four inoculated tubes on the 25th December; they were situated at the top of the slants towards the glass surface, as in the majority of these cultures. There was no development of a true pileus, but a hymenial surface was formed which agreed in colour and in all other essentials with that found in nature. It was very noticeable that the two tubes which had fructified showed very poor growth of the vegetative mycelium. The pores contained no basidia, but a number of spores which resembled the normal spores in colour, size, and measurement. As in all cases, several crystals were found within the pores. There was a copious spore-fall from these fructifications on the glass surface of the culture-tubes.

(6) *Lenzites malaccensis* Sacc. & Cub.

(Spore-culture.)

Lenzites malaccensis (Pl. 23 fig. 14) was collected from the forest of Kulsi Range, Kamrup Division, in Assam, in January 1925, growing on a stump. The hymenial surface is divided into a number of gills, running divergently parallel; most of the gill-walls, which are composed of two layers, are separate for about two-thirds of their length, after which they become united. The lower surface turns yellowish in old specimens, and the upper surface is white and smooth and studded with small pustules. In the dried condition it is rather tough, thick, and coriaceous. On the 26th February the spore-deposit from a piece of a good sporophore was taken. A number of isolated spores had germinated on poured agar-plates after two days, and several monosporous mycelia were transferred to sterilized malt-extract agar tubes and flasks, and to sterile Roux tubes containing sterilized blocks of dead but compact wood of *Tamarindus indica*, *Spondias mangifera*, and *Albizzia Lebbek*, with a little sterile water at their bases.

A number of subcultures were grown in a series of tubes containing the same media. All the cultures were kept within a glass chamber at room temperature. White hyphæ grew out abundantly; discolouring of the malt-extract agar medium was not pronounced, but ultimately the old hyphæ acquired a faint yellowish tinge. In many of the tubes there was an exudation of glistening drops of liquid. Pairing of a number of monosporous mycelia was done on the 18th April in Petri-dishes containing sterilized malt-extract agar media.

In some of these pairings of two monosporous cultures, examined after a month, a number of clamps, hyphal anastomoses, and chlamydospores were noticed. Lyman (1907) has remarked that about 40 per cent. of Polypores in pure spore-cultures possess some secondary method of reproduction, usually mycelial oidia or chlamydospores.

A monosporous mycelium, about seven months old, grown in agar medium on a slide, then fixed in Fleming's strong fluid and stained with Heidenhain's iron-hæmatoxylin, showed a large amount of oidia in chains, and a number of cysts and of helicoid hyphal formations, with the mycelium breaking up into oidia, similar to those observed by Rhoades (1918, pls. ix and xiv and text-fig. 4).

On one of the wood-blocks of *Albizzia Lebbek* a distinct browning of the white hyphæ in patches was noticed soon after the inoculation. The tamarind-wood was fully covered by a white felty mycelium, which turned brownish towards the upper end. No fructification has as yet been formed and the wood remains apparently unaffected. On two other kinds of wood-blocks the mycelial growth was poor, occurring in patches here and there; one of them (on *Spondias mangifera*) had produced a fructification (Pl. 23. fig. 15), forming the porous surface which recalls the genus *Poria*, after an interval of about four months. In all old cultures the hyphæ, where they formed a dense mat, turned brownish here and there; and in the flask-cultures they grew out of the media, forming dense clusters and knots in concentric rings round the glass surface, immediately above the level of the medium.

One of the pairings of two monosporous mycelia in a Petri-dish, which did not unite (probably both being of the same sex), had fructified in October, after an interval of about six months from the date of inoculation (Pl. 23. fig. 16). Two spots, bearing elongated wide pores, are clearly shown in the photograph. The normal sporophore, with the hymenial surface bearing divergently parallel gills, was absent in the culture. A section of the pore surface revealed a number of white oval spores, measuring 3 × 2 μ, and several crystals.

I hope to communicate the results of my study on the sexuality of these hard fungi (*Lenz. malaccensis*, *Tram. lactinea*, etc.), based on monosporous cultures, in a later paper. The work is at present in progress.

(7) *Ptychogaster*.

This *Ptychogaster* has often been collected, usually from July to January, in Calcutta and the suburbs, growing on the outer bark of the trunk of standing, as well as dead, *Cæsalpinia pulcherrima* trees in the form of a conspicuous, thick, irregular, yellowish-brown, swollen, and globular mass. It secretes a large number of yellowish drops on the outside. The colour changes from yellow to deep brown in old specimens. Usually the *Ptychogaster* is associated with the fructification of a big *Polyporus*—*Polyporus* (*Xanthochrous*) *calcuttensis* Bose—at its base A full description of this *Polyporus* has already been published by me (1925). I have established by means of artificial culture that the conidia of this *Ptychogaster* ultimately give rise to sporophores of *Polyporus* *calcuttensis* in culture tubes. Boudier, Patouillard, de Seynes, and others have likewise shown, by culture-studies and by the discovery of basidiosporic hymenia, that some of the Ptychogasters are definitely connected with certain members of Polyporaceæ.

A very small powdery piece of the *Ptychogaster*, containing a number of deep brown, round, thick-walled conidia, was put aseptically into ordinary potato-agar tubes on the 29th July, 1925. Brownish patches of mycelium were soon developed on the slant, which in course of time deepened into blackish-brown areas here and there. The culture-tube was kept in a slanting position in a glass chamber, and the slanted surface of the medium was exposed to the diffused light and ordinary temperature of the room. By the 31st October these areas on the edges of the slant in contact with the glass surface of the tube developed into a hymenial surface characteristic of *Polyporus calcuttensis* (Pl. 23. fig. 17). No pileus was formed, but microscopic examination of the pores revealed a number of spores which resembled the normal basidiospores of *Polyporus calcuttensis* in shape, colour, and measurement. No basidia could be found.

(8) *Polyporus calcuttensis* Bose.

(Spore-culture.)

From a piece of the normal sporophore of *Polyporus calcuttensis* growing in nature the spore-deposit was taken on the 16th September, 1925. On the 18th a number of monosporous mycelia were transferred from poured agar plates to sterile tubes containing sterilized malt-extract agar. In all these monosporous cultures the hyphæ, which assumed a faint pinkish colour from the beginning, soon broke into chains of oidia, and sometimes into budding yeast-like cells. Externally the mycelium assumed a somewhat floury appearance. The vegetative mycelial growth was poor ; and later on, in the course of about two months, it gave rise to small, scattered, abnormal, and faintly pink hymenial spots, which contained a large number of white oval spores, measuring 4 × 6 μ. The mycelium did not discolour the malt-extract agar medium. The characteristic yellow colour of the hymenium and of the spores was not reached. The spores agreed in shape and measurement, though not in colour, with the normal basidiospores.

From these monosporous cultures a number of transfers were made on the 7th November to sterile Roux tubes, containing sterilized blocks of dead but compact wood of *Cæsalpinia pulcherrima* (the natural host of the fungus) with sterile water at the base. In the beginning the hyphæ similarly broke up into chains of oidia. All of them, in the course of about three to four months, gave rise to abnormal, scattered, pinkish hymenial patches (Pl. 24. figs. 18 & 19), similar to those found in the malt-extract agar tubes. The mycelial growth on the wood-blocks was very poor. Microscopic examination of the pores revealed a large number of the same white oval spores. I think that in the deeply coloured hymenial tissue of the normal *Polyporus calcuttensis* the spores become coloured, whereas the very faintly coloured hymenial surface in the artificial culture gives rise to white spores. In this respect it may be compared to *Xanthochrous radiatus* of France, which has two kinds of spores of the same dimensions, some hyaline and some yellow. Probably spores become coloured by the colour of the hyphæ of the pore-tissue during the rains.

(9) *Trametes lactinea* Berk.

(Spore-culture.)

Trametes lactinea is a common saprophyte here, growing on logs, on dead and prostrate trunks, and also at the bases of dry Sundri trees (*Heritiera minor*) in the Sunderbans forests. It has a wide distribution in the tropical zones of both the eastern and western hemispheres, occurring in Ceylon, Singapore, in different parts of Bengal, Cuba, New Zealand, and also in South Australia. I have previously (1920 *b*) published a systematic description of it.

Some young sporophores were collected from the forest of Kulsi Range, Kamrup Division, Assam, in January 1925, growing on the dead branch of a felled Sal tree (*Shorea robusta*). The spore-deposit was taken on the 2nd April. Spores had germinated on poured agar plates by the 4th April, when a monosporous mycelium was transferred to a sterilized malt-extract agar tube, and a polysporous mycelium was directly transferred to a sterilized block of dead but compact wood of *Mangifera indica* within a Roux tube with a little sterile water at the bottom. The monosporous snow-white mycelium grew quickly on the malt-extract agar medium, and gave rise to a number of glistening drops ; the hyphæ bore a number of sphæro-crystals ; sometimes sharply pointed acicular crystals were noticed. The discolouring of the malt-extract agar medium was slight.

The mycelium broke up freely into chains of oidia (see Pl. 24. fig. 20), and the hyphæ were regularly uninucleated. In older cultures chlamydospores were also noticed.

On the 18th April a fragment of the monosporous mycelium was transferred aseptically to a sterilized block of dead but compact wood of *Spondias mangifera* within a Roux tube. The growth on both the wood-blocks was very slow at first. The Roux tubes with the wood-blocks were kept in a slanting position in a glass chamber, exposed to the diffused light and kept at the ordinary temperature of the room. In about three months the growth of the mycelium on the wood-blocks was quite conspicuous. In the monosporous mycelium growing on *Spondias mangifera* the wood became completely covered by quite a thick felt of white interwoven hyphæ, which turned deep yellow on the upper face ; whereas the polysporous mycelium growing on *Mangifera indica* covered only one side of the wood, passing in course of time to the other contiguous side of it ; here, also, the upper end turned yellow. By September stalk-like structures grew out of the upper ends of both the wood-blocks towards the glass surface into the empty cavity of the tubes ; they subsequently became attached to the inner surface of the glass, their tips showed branching, and these branches ultimately bore fructifications.

In the monosporous mycelium a small but typical pileus with the lower surface hymenial was formed ; one was noticed in September and another perfect pileus was noticed in March 1926 (Pl. 24. figs. 21 & 22).

In the polysporous mycelium, also, a small rounded fructification (Pl. 24. fig. 23), with pileus and hymenial surface, was formed after an interval of about eleven months in March 1926 ; the pores on the hymenial surface were, however, somewhat elongated, depending on the uneven plane of growth The nature of the pilei and the character of the hymenial surface in each were the same as in the sporophores formed in nature. The change of colour of the sporophore from white to yellow that occurs in old sporophores growing on logs in the open was noticed in the course of time in these artificial cultures.

In connection with pure cultures of wood-rotting fungi grown on artificial media, Long and Harsch (1918) remark that true pilei are formed in artificial cultures only when rays of light fall on the tops of culture-tubes and none on the sides or the bottom ; but when culture-tubes are so placed that the slant faces the light in such a manner that the rays are more or less at right angles to the surface of the medium where the hymenium is being formed, only the hymenial surface without any pilear development will be formed. However, both the Roux tubes with wood-blocks inoculated with the mycelium of *Trametes lactinea* were placed in a slanting manner within a glass cupboard in such a way that the rays of light fell on the tubes from almost all sides, as well as from the bottom and the top ; even so they gave rise to true pilei. On the other hand, a malt-extract agar Petri-dish inoculated with a fragment of the mycelium from one of the wood-blocks on the 22nd February, 1926, and kept on a shelf of the glass cupboard, produced only hymenial patches (Pl. 24. fig. 24) in the course of a fortnight, although it was similarly exposed to the ordinary diffused light of the room. I think, therefore, that no clear connection between the direction of the rays of light and the formation of the pileus can be established, at least in this species.

The directive influence of gravity on the formation of the porous surface of sporophores was clearly shown by reversing the original position, with reference to gravity, of the polysporous fructification of *Trametes lactinea* on a wood-block of *Mangifera indica*. A number of pores were subsequently developed on the former pileus (Pl. 25. fig. 25).

Long before the formation within the two Roux tubes of the typical pilei away from actual contact with the wood-blocks, some resupinate patches of abortive porous surface, exhibiting the characteristic features of the genus *Poria*, were formed here and there on the wood-blocks themselves. The latter were completely decayed and reduced to a soft friable mass by the mycelial growth. Ordinarily sporophore formation in artificial cultures is associated with a poor vegetative mycelial growth, but the mycelial growth on both the wood-blocks, especially that on *Spondias mangifera*, was quite vigorous. The sporophores were formed on the tips of stalk-like structures, which grew out of the wood-blocks within the dry air of the cavity of the tubes. Robinson (1926) remarks that the reproductive structures arise in cultures on solid media, after the growth of the mycelium over the surface has been checked. In ordinary cultures this is brought about by the growth of the hyphal extremities away from the moist agar-surface into the drier air at the margin of the culture. Probably a similar state of things took place here in the wood-block cultures of *Trametes lactinea*.

A section of the pore-surface showed a number of normal pore-tubes, in which basidia and basidiospores were seen.

(10) *Polystictus hirsutus* (Wulf.) Fr.

(Spore-culture.)

Polystictus hirsutus is very common here in Bengal, occurring as a saprophyte on dead wood, prostrate trunks, etc., throughout almost the whole year. This species has a very wide distribution, occurring throughout the tropics, in Australia, Madagascar, East Africa, etc. I have previously (1920 *a*) published a systematic description of it. Fresh sporophores were collected from the outer bark of a branch of the famous banyan tree in the Royal Botanical Gardens, Sibpur, on the 8th November, 1925. The spore-deposit was taken two days later. On the 12th a number of polysporous mycelia were transferred from poured agar plates to malt-extract agar tubes. The tubes were kept exposed to diffused light at the ordinary room temperature. The mycelium grew rapidly. In the course of about a month it covered the entire surface of the slant. It was snow-white to start with, but after that turned yellow in patches, the older hyphæ becoming yellow. A number of crystals were found on the walls of the hyphæ, as in other cases. The ultimate discolouring of the malt-extract agar medium was also noticed. By the 1st February, 1926, after an interval of about two and a half months, a number of yellowish-brown hymenial patches were found at the top of the slants in contact with the glass surface of all the tubes (Pl. 25. fig. 26). The vegetative mycelial growth was neither vigorous nor luxuriant. The colouring of the hymenial patches agreed with that of the sporophores growing in the open. Sections of these thin patches revealed a number of small round pores, in which a number of oval spores in clusters resembling the normal basidiospores were found. No basidia, however, were seen.

A Petri-dish culture in malt-extract agar from a polysporous mycelium also fructified similarly in the course of about three weeks, forming thin brownish-yellow hymenial patches on the border-line of the medium close to the glass lid of the Petri-dish, where a number of spores were distinctly seen (Pl. 25. fig. 27).

(11) *Polystictus velutinus* Fr.

(Spore-culture.)

Polystictus velutinus was collected fresh from Pashok (Darjeeling) at an altitude of 2500 ft. in January and February 1927, growing on dead wood of *Alnus nepalensis* one above the other in imbricate fashion. This species has a very wide distribution, occurring in Europe, Asiatic Siberia, Sarawak, Borneo, Java, Philippine Islands, Japan, Middle Carolina, Cuba, Central and South America, Australia, New Zealand, and South Africa. I have published a systematic description of it with plates (1927). It comes close to *Polystictus hirsutus,* from which it differs in having the upper surface very soft and velvety and very faintly zoned.

The spore-deposit from a fresh piece of sporophore was taken on an agar plate on the 9th February. On the 11th a number of polysporous mycelia were transferred from poured agar plates to malt-extract agar tubes and Petri-dishes. The tubes and Petri-dishes were kept exposed to diffused light at the ordinary room temperature. The temperature and humidity varied from 82° to 98° F. and from 68 to 75, respectively. The growth of the mycelium was rapid. The surface of the media was soon covered by a white felty growth, in which two kinds of hyphæ were noticed—some narrow and others broader. The hyphæ showed a number of crystals of different forms on the outside. The older hyphæ bore a number of oidia formed in chains. There was a marked discoloration of the malt-extract agar medium, the colour becoming pale yellow, at places almost white. The formation of hymenial patches was noticed at the upper ends of slants (Pl. 25. fig. 28) within the tubes on the 22nd March and in the Petri-dishes a number of thin hymenial patches were formed on the border-line of the medium (Pl. 25. fig. 29) in contact with the glass surface of the wall of the dish on the 9th March. The porous surfaces, at first pure white, in the course of time acquired a light yellow tinge. A subculture from the first set, inoculated on the 2nd March, fructified on the 30th, small sporophores covered with soft velvety yellowish hairs being found on the upper edges of slants, in contact with the glass surface of the tubes as before. A subculture from the second set fructified after an interval of eleven days, and that from the third set after an interval of eight days only. One of these subcultures gave rise to a normal sporophore within the tube at the upper end of the slant (Pl. 25. fig. 30), the upper surface of which was soft and minutely velvety, gradually acquiring a yellowish tinge, and the lower surface was hymenial. A mycelial transfer to a sterilized wood block of *Spondias mangifera* within a Roux tube with sterilized water at the constricted end has not yet formed sporophores after an interval of about eight months, but persists in vigorous vegetative condition, the wood being covered all over, specially at the lower part, with a white woolly hyphal growth forming yellowish patches here and there, the wood itself remaining apparently sound.

Sections of these hymenial patches revealed a number of small round pores, in which no basidia were found, but only a number of white oval spores resembling the normal basidiospores.

(12) *Polyporus ostreiformis* Berk.

(Spore-culture.)

Polyporus ostreiformis is common in Bengal, growing as a saprophyte on dead wood and prostrate trunks in forests. This species has been reported from the Philippine Islands and Ceylon. I have published a systematic description of it with plates (1921). A fresh specimen was collected from our College-compound on the 10th September, 1927. The spore-deposit from a small portion of the sporophore was taken on the same day on an agar plate. On the 12th a number of polysporous mycelia were transferred from poured agar plates to malt-extract agar tubes. The tubes were kept at the ordinary room temperature of the glass chamber. During the period of growth the temperature and humidity varied from 83° to 88° F., and from 68° to 70°, respectively. In the course of fifteen days a number of hymenial patches (abnormal sporophores) were formed at the upper ends of the slants in contact with the glass surface of the tubes (Pl. 25. fig. 31), as in other cases. The vegetative growth of the white felty mycelium on the surface of the media was rather poor. Two kinds of hyphæ were noticed, some narrow and others broader. The porous surface at first looked pure white, then gradually acquired a yellowish-brown tinge The discolouring of the malt-extract agar medium was very slight, almost nil. Excretion of a number of crystals by the hyphæ was noticed, and a number of clamp-connections on the hyphæ were distinctly seen, chlamydospores being also found. Examination of the porous surface showed a number of spores resembling the normal basidiopsores; probably these are secondary spores, as noted by Baxter (1924); no basidia, however, were seen.

GENERAL REMARKS.

The Germination of Basidiospores and the Presence of Basidia.

The spores of many Hymenomycetes are difficult to germinate; and in others, though the spores germinate, it is difficult to obtain the final fructifying stage. No satisfactory explanation of the cause of this failure can be offered; but it is a hopeful sign that, with the advance of time and of consequent knowledge a number of species are being gradually added to the list of those of which artificial culture from the spore is possible. In connection with my cytological study of the sporophores of Polypores, collected at different times of the year, I have found that it is rather rare to get sporophores with basidia; probably the basidia collapse soon after their formation and the discharge of their spores; they may reappear in favourable seasons. Buller (1922–24) has remarked that in Agarics basidia collapse soon after the formation and the maturation of the four spores at the apex, and that the place of the collapsed basidia is at once taken up by basidia of the second generation, and so on. But I am of opinion that in cultures of Polypores succeeding generations of basidia are not immediately formed; at least, I could get no indication of such in the sporophores of the species that I have studied. Faull (1921) has observed that each annual hymenial layer of tubes in *Fomes fomentarius* may produce a crop of spores for four years in succession. As noted by Buller (1922), further elucidation is required as to whether the same hymenial layer functions each year by the pushing up into it of new basidia developed from the sub-hymenium, or whether four new hymenial layers are formed one above the other, thus slightly narrowing the diameter of the tube. As an instance, I might cite the example of *Ganoderma* (*Fomes*) *lucidum* (Leys.). This species is cosmopolitan, and I have collected it abundantly from different parts of India and Europe at almost all times of the year; but in one or two instances only have I been able to find basidia with in its tubes, though spores are quite common.

The Influence of Gravity.

In all cases it was noticed that the fruit-body as a whole was positively geotropic, that the pores were formed parallel to the force of gravity, and that, in true pilear development (as of *Trametes lactinea*), a crust was formed on the upper surface of the fruit-body and the hymenial surface on the under side owing to the stimulus of gravity.

The position of the pores of a growing sporophore could be easily changed simply by reversing the original position of the culture-tube with reference to gravity. This was noticed previously in the polysporous fructification of *Trametes lactinea* (Pl. 25. fig. 25), where the pores were formed on the former pileus in the reversed position.

The Influence of Sunlight on Cultures.

The cultures were kept within a glass chamber, and were exposed to the diffused light of the room from 11 A.M. to 6 P.M. every day except Sundays. The wood-block cultures were kept in Roux tubes in a slanting position, while the test-tube cultures and the flask-cultures were kept in a vertical position. Two wood-block cultures of *Lenzites malaccensis* were kept entirely in the dark within a box in a dark room for about seven months; in both, the mycelial growth was very vigorous, and in one case a brown patch in the white mycelium was noticed from the beginning. Both of them remained sterile. Sporophore-formation was noticed only in cultures that were exposed to light, and in the majority the sporophore-formation was associated with a poor vegetative growth. Thus, the general effect of light seems to be, as noted by Long and Harsch (1918), to check the vegetative growth, and this is ultimately followed by sporophore-formation.

Records of Temperature and Humidity.

A thermograph was kept on a shelf within the glass chamber of the culture-room. The temperature varied from 78° to 81° F. in the months of October and November, 1924, and February and March, 1925, and from 73° to 75° F. in December, 1924, and January, 1925; the humidity usually varied from 65 to 70 in the months of October and November, 1924, and February and March, 1925, and from 58 to 60 in December, 1924, and January, 1925.

The Position of Sporophores on Media.

In most cases of sporophore-formation within the tubes it was noticed that they were formed on the upper end of the slant towards the glass surface, as has also been noted by Long and Harsch (1918). Even when the sporophore was formed on the sides or at the bottom of the slant it was always away from the moist agar surface towards the glass surface, and in Petri-dish cultures the fructification was mostly noticed close to the glass lid (Pl. 23. figs. 27 & 29); it was rare (I observed it only in *Polystictus sanguineus*) that sporophore-formation was seen about the middle of the slant entirely within the medium. Probably it is dependent upon the drier air at the margins of the culture. But, besides this, there is a definite correlation between internal metabolic changes of the fungus causing diminution of vegetative growth and the formation of sporophores. This has been treated at some length in an interesting paper by Robinson (1926 *b*). He remarks that "in the determination of the transition from purely vegetative growth to the development of reproductive structure the primary factors appear to be the internal metabolic changes associated with a diminution of growth."

The Density of the Mycelium and Sporophore-formation.

It has been noted in the course of my work that almost all cases of sporophore-formation have been associated with a poor vegetative mycelial growth. The works of Klebs (1898, 1902) and Robinson (1926 *b*) show that there is an antithesis between the vegetative growth and reproductive activity. Robinson remarks that "if the conditions of culture are so arranged that there is no falling-off in the growth-rate, then no reproductive structures are produced." This happened with some of the wood-block cultures of *Trametes gibbosa*, *Polyporus adustus*, *Lenzites malaccensis*, and *Polystictus velutinus*, where the mycelial growth on the wood-blocks was quite vigorous and continuous, with the consequence that fructifications have not as yet appeared. Only in two wood-block cultures of *Trametes lactinea* was the mycelial growth quite vigorous, and still they ultimately bore fructifications; but the sporophores were situated on the tips of stalks, projecting about 3 cm. out of the upper end of the wood-blocks, within the dry air of the cavity of the tubes. I agree with Robinson (1926 *b*) that here probably a check on the mycelial growth over the surface of the wood was brought about by growth of the hyphal extremities away from the moist wood-surface into the drier air within the cavity of the tubes, where alone the fructifications were formed. In almost all wood-block cultures in Roux tubes it was noticed that the mycelial growth on the lower ends of the wood-blocks, in actual contact with water, was very vigorous, and that some of them actually travelled down to the watery surface, growing luxuriantly and forming a dense floating mycelial mat, which persisted in the vegetative condition.

The Length of the Life-cycle in different Media.

It was found, in the course of my work with different species, that in artificial cultures on blocks of wood the length of the life-cycle was prolonged, while in the tube- and plate-cultures of malt-extract agar it was much shorter.

The Development of True Pilei in Artificial Cultures.

In most of these artificial cultures the fungi usually failed to produce typical pilei (*cf.* White, 1920). Sometimes only the hymenial surface with characteristic pore-tubes was formed; in others an elongated patch, consisting of shallow pores and recalling the structure of the genus *Poria*, was formed; while there were some which persisted in the vegetative condition, as noted by Baxter (1924). Sections of these pore-surfaces usually showed a number of spores, which resembled the normal spores in colour, shape, and size; and there was sometimes an enormous deposit of these spores on the opposite sides of the culture-tubes. But I could not find basidia in them. Baxter regards these as secondary spores distinct from basidiospores. Only in the wood-block cultures of *Trametes lactinea* and *Polyporus adustus* and in one of the malt-extract agar tubes of *Polystictus velutinus* was I fortunate enough to get the development of perfect pilei. In this connection I cannot agree with Long and Harsch (1918) that typical pilei can be formed only when the rays of light fall on the tops of and parallel to the culture tubes, and none on the sides or the bottom. My experience with the development of the typical pilei of *Trametes lactinea* in artificial cultures is quite otherwise, as I have noted above.

The Nature of the Media favourable for Fructification of Wood-rotting Fungi.

I agree with Long and Harsch (1918) that no special decoction is necessary for the sporophore-formation of these wood-rotting fungi, and that they can fruit on a wide range of media, just as some strictly parasitic fungi do, irrespective of their special host. In my cultures almost all of them fruited on a purely artificial medium, namely, malt-extract agar.

The old notion of the "specific" nature of some Hymenomycetous fungi with reference to particular species of host-plants was that these supply the nutritive substances necessary for their growth, and hence they are found only on these particular plants. Lutz has observed recently, in the course of his work on a large number of wood-destroying fungi (1925), that this notion of the *specific nature* has no value; that all of them can be grown on artificial media; that their growth is not due to different kinds of nutritive substances in different trees, but to the absence of certain substances unfavourable to their growth within the trees attacked; and that the immunity of a tree with respect to a particular fungus can be broken down by weakening the wood with hot water, and thereby bringing about some alteration or destruction of the antagonistic substance originally present in the tree. It seems possible that this can explain to a certain extent why some of the hard fungi, which were formerly known as true saprophytes, are gradually being discovered as wound-parasites, owing to an internal change in the nature of the trees.

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EXPLANATION OF THE PLATES.

PLATE 22.

Trametes gibbosa (Pers.) Fr.

Fig. 1. Hymenial surface of the sporophore growing in nature.

Fig. 2. White mycelial growth in artificial culture.

Fig. 3. Growth on sterilized wood-blocks, the fungus persisting in vegetative condition.

Figs. 4 & 5. Fructifications formed in artificial cultures within tubes. (Fig. 5 twice the original size.)

Polyporus adustus (Willd.) Fr.

Fig. 6. Imbricate growth of sporophores in nature.

Fig. 7. Hymenial surface of the sporophore.

Fig. 8. Tiny fructifications formed in artificial culture on a sterilized wood-block within a Roux tube (× 2). Fig. 8 (*a*) shows the position of the four sporophores.

Stereum hirsutum (Willd.) Fr.

Fig. 9. Sporophore growing in nature.

Fig. 10. Resupinate fructification formed in artificial culture on a sterilized wood-block within a Roux tube.

PLATE 23.

Polystictus sanguineus Linn.

Fig. 11. Fructification in artificial culture within a tube (× 2).

Trametes cingulata Berk.

Figs. 12 & 13. Fructifications formed in artificial cultures within tubes. (Fig. 13 *a* the original size; other figs. × 2.)

Lenzites malaccensis Sacc. & Cub.

Fig. 14. Hymenial surface of the sporophore growing in nature.

Fig. 15. Fructification formed in artificial culture on a sterilized wood-block within a Roux tube.

Fig. 16. Fructification formed in Petri-dish culture of a pair of monosporous mycelia. (Fig. 16 *a* shows the location of two hymenial spots.)

Ptychogaster.

Fig. 17. Fructification of *Polyporus calcuttensis* in artificial culture from the conidia of *Ptychogaster.*

PLATE 24.

Polyporus calcuttensis Bose.

Figs. 18 & 19. Fructifications formed in artificial cultures on sterilized wood-blocks within Roux tubes. (Fig. 18 × 1¼. Fig. 19 × 2.)

Trametes lactinea Berk.

Fig. 20. Photomicrograph under oil-immersion lens of a monosporous mycelium copiously breaking up into chains of oidia, and also showing the uninucleated condition of the hyphæ.

Fig. 21. Fructification from a monosporous culture on a sterilized wood-block within a Roux tube.

Fig. 22. Another fructification from the same monosporous culture (× 2).

Fig. 23. Fructification from polysporous mycelium in artificial culture on a sterilized wood-block within a Roux tube (× 1·5).

Fig. 24. Petri-dish culture showing two hymenial spots (*a*) and a shining gum drop (*b*).

PLATE 25.

Trametes lactinea Berk.

Fig. 25. Upper surface of the polysporous fructification becoming porous, due to the reversal of the original position with reference to gravity (× 1·5).

Polystictus hirsutus (Wulf.) Fr.

Fig. 26. Fructication formed in artificial culture within a tube.

Fig. 27. Fructification formed in Petri-dish.

Polystictus velutinus Fr.

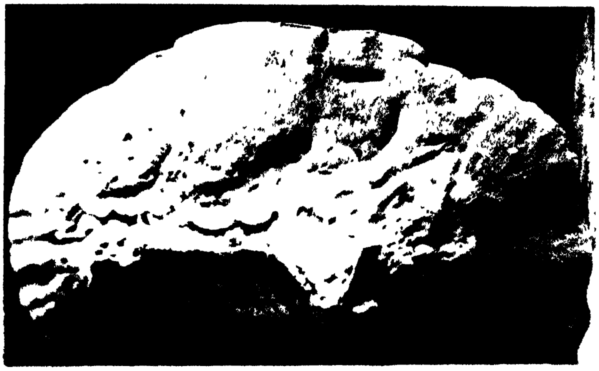
Fig. 28. Fructification formed in artificial culture within a tube.

Fig. 29. Fructification formed in Petri-dish.

Fig. 30. Normal fructification formed within a tube.

Polyporus ostreiformis Berk.

Fig. 31. Fructification formed in artificial culture within a tube.



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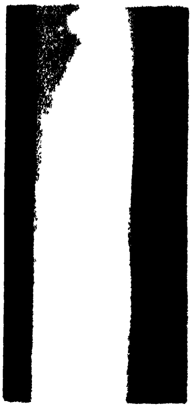

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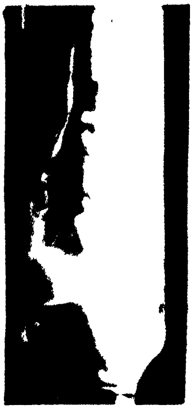

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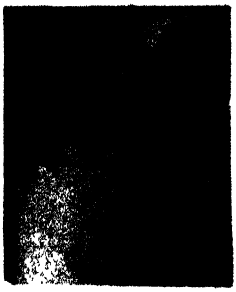

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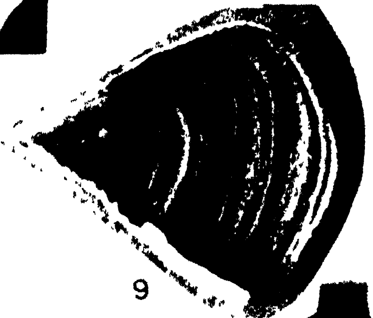

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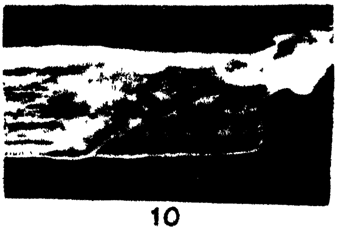

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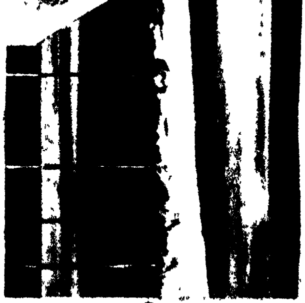
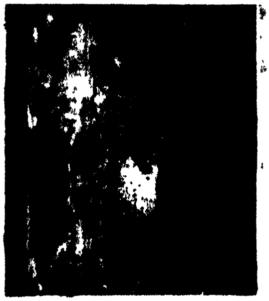


8

WOOD-ROTTING FUNGI.

11



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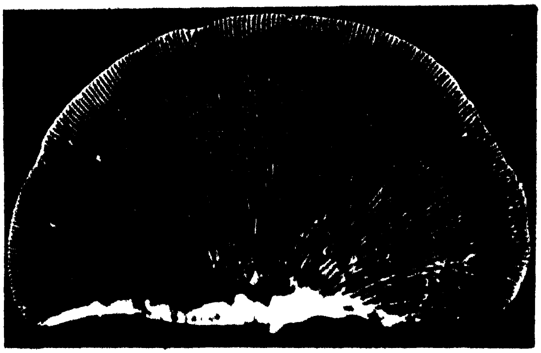

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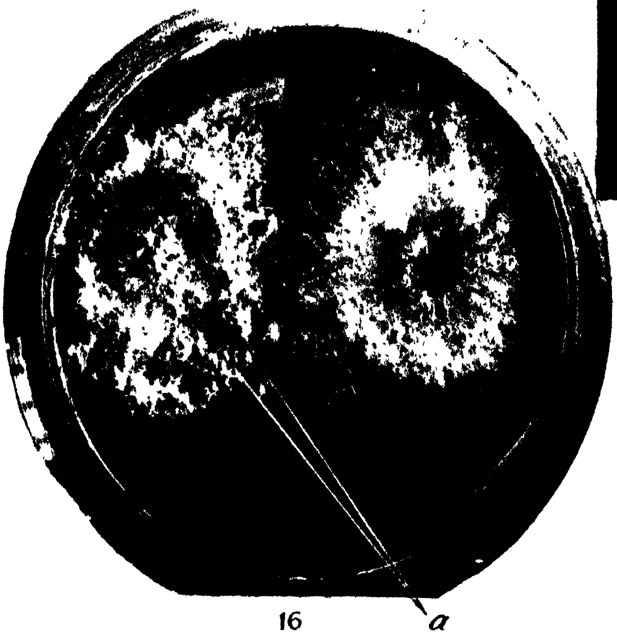

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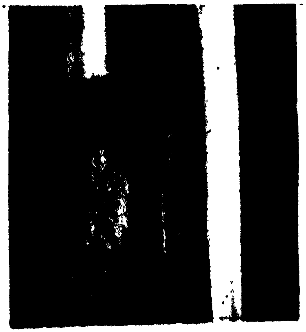
17

WOOD-ROTTING FUNGI.



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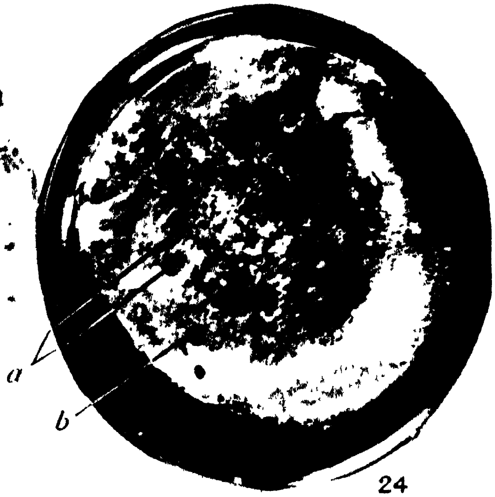

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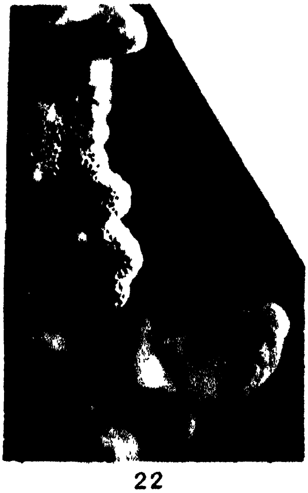

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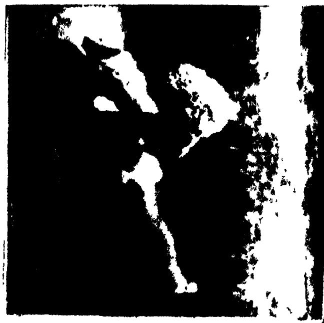
WOOD ROTTING FUNGI.



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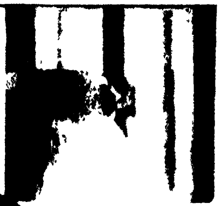

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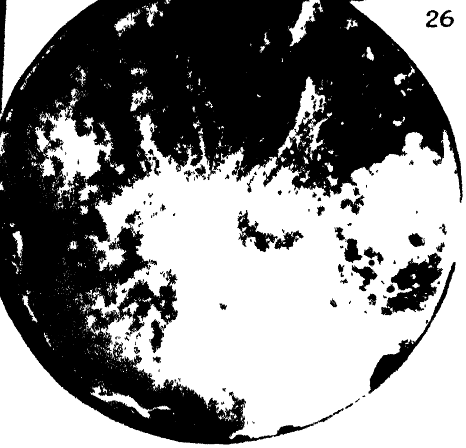

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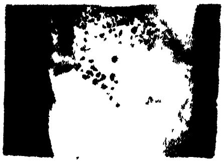

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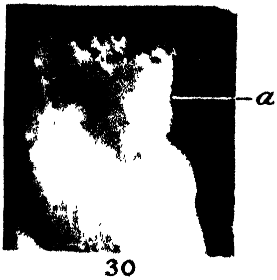
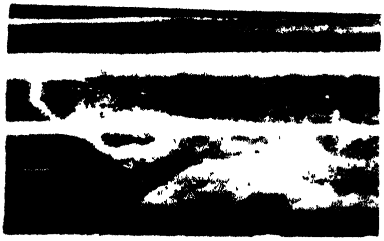


30



31

WOOD ROTTING FUNGI.

Aylmer Bourke Lambert and his 'Description of the Genus *Pinus*.' By H. W. Renkema, Agricultural University, Wageningen, Holland, and John Ardagh, Department of Botany, British Museum. (Communicated by Dr. A. B. Rendle, F.R.S.)

[Read 23rd January, 1930.]

Aylmer Bourke Lambert, only son of Edmund Lambert and Hon. Bridget Bourke, daughter of John, Viscount Mayo, was born at Bath, February 2, 1761. A passionate collector from his boyhood, especially in the field of botany, Lambert, before he was old enough for school, had formed a little museum at Boyton House, near Heytesbury, Wilts, his father's seat. A pencil drawing of the house by James Sowerby, dated July 16, 1808, is in the possession of J. B. Sowerby, Esq., of Chertsey. He matriculated in January 1779 at St. Mary Hall, Oxford, where he became acquainted with the botanist and topographer, Daniel Lysons, and shortly afterwards with Joseph Banks and James Edward Smith.

After his father's death (1802), Lambert was enabled to indulge his taste for botany. He removed from Salisbury to Boyton, where he busied himself in enlarging his herbarium, which, in time, became one of the most valuable and important private collections, containing about 30,000 specimens.

This collection was freely open for the use of men of science, and Lambert set Saturday apart for the reception of scientific visitors, who brought with them, or sought information on, botanical matters. In his ' Life of Bentham,' Dr. B. D. Jackson refers to a visit paid by Bentham and Alphonse de Candolle to Lambert at Boyton (p. 70), and also quotes a reference by Bentham to Lambert's keenness for fine specimens (p. 78).

Of his herbarium and the principal collections of which it was composed, a full account is given by David Don in the second volume of Lambert's ' *Pinus* ' (1824). This also appears, with some abridgement, in Sir R. C. Hoare's ' Modern History of South Wiltshire ' (i, 214–322). Don was, for many years, Curator of Lambert's herbarium and botanical library, and was also Librarian to the Linnean Society 1822–41. Further particulars of the collections are to be found in three Catalogues, copies of which are in the Department of Botany, British Museum (with purchasers' names and prices), at Kew, and elsewhere, namely (1) Catalogue of the valuable botanical library of the late A. B. Lambert —Which, by order of the Executors, will be sold by auction, at 26 Lower Grosvenor Street (the residence of the late Mr. Lambert) . . . on April 18th, 1842, and Two following Days. 42 pp.; (2) Catalogue of some few paintings, drawings, prints . . . which . . . will be sold . . . on April 21st . . . 8 pp.; and (3) Catalogue of the highly valuable botanical museum . . which . . . will be sold . . . June 27th . . . and Two following Days. 16 pp. See also Lond. Journ. Bot. i, 395 (1842).

The account of the sale in Gard. Chron. April 23, 1842 (p. 271), and July 2nd (p. 439), states that the books realised about £1,110 and the plants £1,170. A portion of the herbarium, including the valuable herbarium of Ruiz and Pavon, was purchased by Robert Brown for the British Museum, and another portion by Delessert. From the library the Dept. of Botany (British Museum) acquired the MSS. of Ruiz and Pavon relative to their botanical exploration in Peru and Chili (1777–88), including the journal of the voyage and descriptions of plants, this lot being withdrawn from the sale; it also has Lambert's copy of Sole's 'Menthæ Britannicæ' and his copy of Hudson's 'Flora Anglica' (1778) with MS. notes; a similar copy, "the manual of his youth" (Dict. Nat. Biogr. xxxiii, 7), is in the British Museum (Bibl. Banks, 447 *a*, 14–15). In 1841 Lambert presented a copy of Cramer's 'Papillons exotiques' to the British Museum; this work, now in the Dept. of Zoology, had been the property of H. Seymer, by whom it had been annotated, and some of the plates retouched. A volume (Bibl. Hook.) containing over 200 letters addressed to Lambert (1781–1841) and 25 letters from him (*cf.* Kew Bull. 1891, 326) to Sir W. J. Hooker, Lindley, Bentham, and John Smith are at Kew. Two letters from Lambert to Robert Brown are in the Dept. of Botany, British Museum.

On the foundation of the Linnean Society in 1788, Lambert became a Fellow, and from 1796 to his death, a period of nearly fifty years, was one of its Vice-Presidents, being the last survivor of the original members, and "the last, as I have been informed, who wore in the Chair, the presidential three-cornered hat" (Huxley, 'Life and Letters of Sir J. D. Hooker,' ii, 429). Edmund Lambert, his father, was F.L.S. from 1797–1802, and contributed "Observations relating to the Migration of Birds" to Trans. Linn. Soc. iii, 12.

Finding that Boyton did not suit his health, Lambert, after the loss of his wife (*née* Catharine Bowater), left his country seat and took a house at Kew Green)†, preferring the proximity of the Royal Botanic Garden. Here he died on 10 January, 1842, having nearly completed his 81st year; he was buried at Boyton. Sir J. E. Smith dedicated to him the genus *Lambertia* (Proteaceæ), and describes him as "one of the most ardent and experienced botanists of the present age, whose ample herbarium and library are ever open to the cultivators of his favourite science, as his heart is to the best feelings of friendship" (Rees's Cyclopædia, xx). Martius founded a new genus, *Aylmeria* (Caryophyllaceæ), and Douglas honoured him in *Pinus Lambertiana*. He is also honoured in the specific names *Scaveola Lambertiana* De Vriese and *Haake Lamberti* Sweet.

The Linnean Society has three portraits of Lambert: (1) in crayon by J. Russell, R. A., pres. by Robert Brown, 15th Nov., 1853; this is engraved in line and stipple by Holl in R. J. Thornton's 'New Illustration of the Sexual System of Linnæus' (10 April, 1805): (2) in oils by an unknown artist; (3) a miniature plaster bust by R. C. Lucas, dated 1832. There are also (4) the engraved frontispiece to his 'Description of the Genus *Pinus*,' vol. i (1803) and (5) engraving by W. Evans from a drawing by H. Edridge in Cadell's 'Contemporary Portraits' (1811).

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† Mr. Skan informs us that the address "10 Cumberland Place, Kew," appears on some of Lambert's letters at Kew; this is near the Cumberland Gate, and is now 300 Kew Road, but it is hardly "Kew Green."

Lambert's 'Description of the Genus *Pinus*,' one of the most splendid publications of its day, is his best-known work; but he also wrote 'A Description of the Genus *Cinchona*,' and many botanical and zoological papers, published mainly in the 'Transactions of the Linnean Society'; these are listed on p. 464.

As stated by Dr. J. Valckenier Suringar (Med. Landbouwhoogeschool, 1926, xxx, 63), again and again one finds citations of Lambert's '*Pinus*,' which are contradictory and give rise to confusion. This is due to the fact that not only was the work issued over a long series of years, but also, and to a high degree, to the circumstance that copies of what is apparently the same issue do not always agree in contents and arrangement; in addition, many errors have escaped the notice of correctors.

The following are the editions of the work. The notes in [ ] indicate copies available in London:—

(1) 1803 [-7]-24. fol. 2 vols. [Brit. Mus., Dept. of Printed Books (2 copies) and Dept. of Botany; Linnean Society (2 copies of vol. 1, but no copy of vol. 2); Kew].

(2) 1828-37. fol. 3 vols. [Brit. Mus. (Dept. of Printed Books); Linnean Society (copy marked vol. ii, but containing a few plates from vol. i (see list of contents on p. 463).

(3) 1832. 8°. 2 vols. [Brit. Mus. (Depts. of Printed Books and Botany); Kew; Linnean Society; Lindley Library].

(4) 1837 [-42]. fol. 3 vols. [Brit. Mus. (Dept. of Botany)].

(5) 1842. 8°. (Text), fol. (plates) 2 vols. [Lindley Library].

Pritzel (Thes. Lit. Bot.) and Jackson (Guide Lit. Bot.) quote only the first three editions.

Each issue of the work appears to be made up, with many irregularities, from the material available, at the time, to the publishers. A quantity of letterpress, principally of the appendix, and some loose plates formed item 410 at Lambert's sale.

Usually it is insufficient to quote the work by the number of the edition alone; it is preferable to add also the year of publication.

It is customary to regard the two volumes of 1803-7-24 as constituting the whole first edition, and to consider vol. iii (1837) as belonging to the second edition.

In the 'Bradley Bibliography' (ii, 12), however, the first edition is quoted thus: 3 vol. port. 96 pl. F°. London, 1803-37; this copy, in the library of the

Arnold Arboretum, is composed of a vol. i with 47 pls., vol. ii with 22 pls., and vol. iii with 27 pls., and was purchased from William Wesley in 1906. Quaritch's General Catalogue, 1887, p. 180, mentions (item 1243) an edition like this, and adds "to this copy have been added such new plates and letterpress as appeared in vol. i and ii of Weddell's edition [*i.e.* 1828], thereby combining the beauty of the colouring of the old edition with much new matter." No doubt vol. iii was intended to complete both the first and the second editions.

EDITION 1803[-7]-24.

VOL. I. A description of the genus *Pinus*, illustrated with figures, directions relative to the cultivation and remarks on the uses of the several species. By Aylmer Bourke Lambert. London. Printed for J. White by T. Bensley. 1803. —It is dedicated to Sir J. Banks. See contents, p. 451. Of vol. i there are copies with and without an appendix. This appendix was probably printed in 1807; according to Bohn it was issued in that year; the last two pages bear the water-mark 1806, and the Annals of Botany, ii, 595 (1 Sept., 1806), states that Lambert is "about giving" an appendix to his work. Concerning contents of the Appendix, see p. 452. A plate of *Pinus Cedrus*, which was described in 1803, without a figure (as a reviewer in Annals of Botany, i, 168 (1804) has pointed out), forms pl. xxxvii *bis* in one of the copies in the British Museum (Dept. of Printed Books), and in the copies in Herb. Mus. Brit. and at Kew.

The Teyler Foundation (Haarlem) copy has 63 pp. and 38 uncoloured pls., also on pp. 65–82 "Some Account of the medicinal and other uses of various substances prepared from Trees of the Genus *Pinus*," by W. G. Maton; on pp. 83–84, "Copy of a letter from Mr. Thomas Davis of Hommingsham, Wilts., relative to the Timber yielded by various species of Pines"; on p. 84, "Extract from the Rev. William Coxe's Travels in Poland, Russia, Sweden, and Denmark on the subject of Christiana Deal," on pp. 85–56, "Copy of a letter from Thomas Marsham, Esq., to the author on the subject of Insects destructive to Pines." It lacks the appendix.

The copy in the Dept. of Botany, British Museum, with W. G. Maton's autograph, has 98 pp., 1 portrait, and 47 pls., which include 41 col. pls., 3 uncol. pls. (xii, xxxiii, and xxxiv *bis*), and 3 partly col. pls. (x, xxix, and xxxviii). The large number of plates is due to the fact that there are two editions of xxi, plain and coloured copies of xxxiv, a pl. xxxvii *bis*, and an unnumbered plate marked in pencil "38*". Pl. v was made from a drawing by G. D. Ehret, dated 1744 - fol. 39 in a volume of Ehret's drawings, bought by Banks from Robert More's library (Catal. Bibl. Banks, iii, 68)–now in Herb. Mus. Brit., pls. ix, xvi, xx, and xxxviii are by Franz A. Bauer; xxxvii *bis*, 38*, xxxxii, and xxxxiii by James Sowerby. Pl. xli is coloured from a drawing by Sydney Parkinson made on Cook's first voyage and now in Herb. Mus. Brit.; the rest are from drawings by Ferdinand L. Bauer, whose originals are also in Herb. Mus. Brit. It has the appendix and is, as stated in a MS. inscription in vol. i, "One of the twenty-five original copies coloured by Mr. Bauer, of Kew "†, and offered for sale at about forty guineas each, the uncoloured ones being sold at ten guineas. There are two copies in the Dept. of Printed Books, British Museum—(1) Bibl. Banks, 454, i, 18, with col. pls. and the appendix, but wanting the portrait; (2) 12 Tab. 70, with uncol. pls., wanting the appendix, pls. xxi *bis*, xxxiv *bis*, xxxvii *bis*, xxxviii *bis*, and the portrait.

The Kew copy (Bibl. Hook.) has the two vols. bound in one, including the appendix, with uncol. pls. wanting xxxviii *bis*; tab. ix is corrected in MS. to *laricis*, x to *halepensis*, and xvi to *pungens*.

Pritzel (Thes. ed. i, 147) gives a statement from a similar copy (Bibl. Imp. France) to that at Kew, but, excepting no. 4, the plates of this copy are coloured. Vol. i (1803) of the Arnold Arboretum copy differs from that at Kew in having additional plates of *P. longifolia*, *P. lanceolata*, and *P. Dammara*, which are uncoloured. The Linnean Society is credited, in their library catalogue, as having 2 vols. fol. 1803–24 and 2 vols. 8^{o}. 1832, but it has since been discovered that they really have (1) vol. i (1803) with inscription "Sir J. E. Smith from his friend the author," with col. pls., including appendix, but portr. wanting; (2) another copy of vol. i (1803) with uncol. pls., wanting the appendix, portr., and pls. xxxvii *bis* and xxxviii *bis*; (3) a peculiar "mixed" copy listed on p. 463, the contents being given in the order of their occurrence in the volume; (4) the 8^{o}. edition of 1832, in two volumes.

VOL. II. A description of the genus *Pinus*, illustrated with figures, directions relative to the cultivation, and remarks on the uses of the several species: also descriptions of many other new species of the family of Coniferæ. By Aylmer Bourke Lambert, to which is added an Appendix containing an account of the Lambertian Herbarium by Mr. Don. Vol. II. London. John Gale and R. Jennings. MDCCCXXIV.

(The 'English Catalogue,' 1801–36, states that it was published in 1825.) Dedicated to Sir R. C. Hoare. See contents, p. 452.

As stated in the preface, this volume is a supplement to the first, which appeared in 1803, and was already held in prospect in the preface to vol. i "with an illustration of the remaining Genera in the natural order of *Coniferæ*. Several drawings are already finished for that purpose of the species of *Dacrydium* and the *Dombeya* of Lamarck, which are intended to be given to the public as soon as possible."

It contains descriptions of other Coniferæ besides *Pinus*, also of *Quercus grandifolia*, *Maclura aurantiaca*, and *Ilex paraguensis*, but not all have plates.

A note as to *P. Laricio* states that in vol. i, for *P. maritima*, has been given a plate of *P. Laricio* (pl. ix). In this second volume a plate of *P. maritima*

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† However, according to Annals of Botany, i, 154, 1804, these were done by William Hooker, a pupil of Bauer, responsible also for the splendid plates in R. A. Salisbury's 'Paradisus Londinensis'; this is confirmed by the extract from the Smithian correspondence, p. 466.

(pl. x) occurs once more, being completed with a drawing of the cone. On p. 25 it is stated, with regard to *Taxodium sempervirens*, " I have been enabled to give the accompanying figure of this interesting tree from a specimen obligingly communicated to me by my friend Mr. Menzies " etc., but it is peculiar, that in all copies plate vii is wanting. According to the explanation in the text (pp. 24–25), this plate represents *Taxodium sempervirens* (fig. 1) and *Dacrydium taxifolium* (fig. 2). In the preface (p. vi), however, the following explanation is given : " For want of sufficient materials I have not been able to complete the drawing of *Dacrydium taxifolium*, the figure of which is therefore necessarily omitted."

Two articles " Extract from a letter to the late J. Stackhouse, Esq." and " On the native country of the Potatoe," and an appendix on the Lambertian Herbarium by Mr. Don, who also wrote the descriptions in the volume, make it up to a volume of 54 pages and 12 plates. Some copies have an unnumbered plate of *Pinus Deodora* between plates 3 and 4 ; this as at Kew, but not in the other copies seen.

As examples of the typographical errors and irregularities, it has been noted in the copies examined, in vol. i (1803), in the " Synopsis of the Species " the first plate is given as tab. 2, p. 58 is given as 56, and p. 59 as 58 ; in vol. ii the pagination is pp. 1–26, 27*–34*, 27–40, 40*, 41–45, *Maclura* is treated before *Ilex*, so that plate xii comes before plate xi.

A divergent copy of vol ii is that which forms part of the above-mentioned first edition in the ' Bradley Bibliography ' (ii, 12). It has a title page and preface for the second edition (1828), but it appears to be a first edition, in which some descriptions and plates of the 1828 editions have been inserted. It contains the descriptions of *Nepenthes Rafflesiana* and *N. ampullaria* from the 1828 edition, but not the plates. This has caused Sargent, in 'Silva of North America ' (xii, 98), to refer to *Pinus spectabilis* as being in Lamb. *Pinus*, ed. 2, ii, 3, tab. 2, whereas in the 1828 edition the real reference is i. p. 54, tab. 34†. The " mixed " copy at the Linnean Society (see p. 463) resembles this one. The copy in Herb. Mus. Brit. has 11 uncol. pls., namely 1–6, 8–12, pls. 1 to 6 by James Sowerby, 8 by J. Lindley (original drawing in Herb. Mus. Brit.), 9 by Fr. Bauer, and 10 by Ferd. Bauer. No pl. 7 was issued. A second copy of the account of the Lambertian Herbarium follows p. [45 *a*]. The British Museum copies (1) 454, i, 19, with col. pls., and (2) 12, tab. 71, with uncol. pls., both want pl. x. The Kew copy with uncol. pls. is complete.

EDITION 1828–37.

VOLS. I and II. A description of the genus *Pinus*, illustrated with figures ; directions relative to the cultivation, and remarks on the uses of the several species : also descriptions of many other new species of the family of Coniferæ.

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† On the same page Sargent gives a quotation for *P. Webbiana*, viz., ed. 2, i, 77, t. 44 (1828), which is incorrect ; it should be ed. 3, ii, 77, t. 44 (1832).

By Aylmer Bourke Lambert. To which is added an Appendix containing descriptions and figures of some other remarkable plants, and an account of the Lambertian Herbarium by Mr. David Don. Second edition. In two volumes. London. Weddell, 1828.

This second edition consists of the two volumes of the original edition, revised by D. Don, with some additional matter. It is dedicated to Sir R. C. Hoare. The title resembles that of vol. ii of the first edition. The volumes are paged and the plates numbered continuously, or, if not numbered, are referred to by numbers in the text. Opposite the title-page is a portrait of Lambert, as in the subsequent editions. See contents, p. 453.

Pritzel (Thes. ed. i, p. 147) mentions a copy and gives an enumeration of the plates. Vol. i, pls. 1–38, vol. ii, pls. 39–51, the appendix pls. i–viii, all of which, excepting the last two, are coloured.

All the plates in vol. i are in ed. i, but some are in vol. ii (1824) of that edition, so there is another arrangement of the contents. A new plate (*P. Lambertiana*), unnumbered, is placed before pl. i. In the preface Lambert says that, just as the work was going to press, he received news of the discovery of a *Pinus*, which Douglas named after him *P. Lambertiana*, and he adds " I shall shortly give a plate of it " ; but there is no description.

In vol. i the twenty-sixth plate, representing *P. excelsa*, is numbered 3, and the thirty-fourth, *P. spectabilis*, is numbered 2. In vol. ii, five plates are unnumbered. All these numbers (except 4) correspond to those of the plates in vol. ii of 1824, from which it appears that a copy was sometimes made up from the material available to the publishers, but it is obvious that much confusion in quotation may result from this.

Don omitted to make in vol. i the correction relative to *Pinus pungens* (see p. 26, note[2]). Rightly, Carrière (' Traité des Conifères,' 334) observes that of the two plates which must represent *P. Tæda*, pl. 18 alone is correct, as pl. 17 shows a branch of *P. Tæda* but a cone of *P. pungens*.

Pritzel (Icon. Bot. Ind.) quotes from the second edition. The plate of *P. Lambertiana* without a number is cited **1*** ; that of *Taxodium sempervirens*, numbered 4 †, as **2**, 48—either following the reference in the text, or because the preceding plate is numbered 47 ; the plate of *Taxodium distichum* he quotes as **2**, 53—it bears no number, but is the 53rd in order ; the plate *Thuja pendula*, also unnumbered, and the 56th in order, he quotes as *2*, 0—it would have been better to have written 56 or 50 *a*, as it follows a plate numbered 50. Some authors on their own account have numbered it 50 *a*, but others, seeing the unnumbered plate between pls. 50 and 51, named it 52 (*cf.* Elwes and Henry, ' Trees of Great Britain and Ireland,' i, 197).

The copy in the Arnold Arboretum library has 73 instead of 66 plates.

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† Here the designer seems to have put a wrong number, which has been scratched out. In the copy at the Prussian State Library, Berlin, the same can be observed ; the 4 is left, underneath it are traces of a 5 or 6.

Pritzel (Thes. Lit. Bot. ed. i, 147) states that "the descriptions to the second and third volumes are by Prof. Don, under whose immediate direction the engravings were coloured in imitation of the originals, and that they have quite the appearance of original drawings. The copy for the convenience of the Purchaser has been put into thin boards, and so sewn that it may immediat[e]ly be bound without resewing (Cat. Lamb. Nr. 408)."

In the second edition there are several inaccuracies. In vol. i, p. 51 is numbered 52, the letterpress to the plates of *Araucaria* is lettered *Arancuria*, both plates being numbered " 47 " ; in the text the second plate is numbered " 47 " *bis*, but is numbered " 48* " in the table of contents. At the foot of the plate of *Thuya dolobrata* is written " *Thuya dolabrata*," at that of *Ilex Martiniana* " *Ilex paraguensis*." The plates are partly numbered with Roman, partly with Arabic numerals. In the Appendix, pl. 2 is by J. Lindley, pl. 5 by J. Lycett. The British Museum (Dept. of Printed Books) has a copy of this edition with col. pls., but pls. xxxvii and 38 are bound in vol. i instead of ii ; it has pls. [42 *a*], [45 *a–d*], [46 *a*], [46 *b*], 47 *bis*], and 48.

Vol. III, 1837. This has a similar title page to that of vols. i and ii, but with the date " MDCCCXXXVII." In Proc. Linn. Soc. i, 138 (1842) " 1834 " is given as the date of publication (with 18 pls.) ; no doubt this is a typographical error for " 1837." The 'Dictionary of National Biography,' xxxii, mentions 1837, and gives 17 as the number of plates. A copy of this edition (3 vols.) was recently offered for £50, and another (vols. i and ii only) for £28.

Loudon (Arb. et Frut. iv, 2150) says, "though only three or four copies have yet, August 1837, been published," he is kindly favoured with the loan of one by His Grace the Duke of Bedford, but it appears from the numbers of the plates quoted by Loudon and by Endlicher ('Synopsis Coniferarum ') that this copy is different in regard to arrangement and number of the plates from the third volume quoted by other authors, and usually considered to be the only edition of vol. iii †.

Probably this issue was very limited in relation to the reprint of the whole work in 1837, when an entirely revised and very enlarged third volume was given.

Seventeen of the species, included in this third volume, were already included in the " editio minor " (1832), and thus it seems probable that what was lent to Loudon was a part, intended to be a complement, for those who had that edition, whilst in 1837 regard was also paid to those who has the folio editions of 1803–24 or 1828, and a third volume was made up, containing both the complement and the seventeen species, published in 1832, the three above mentioned being now furnished with plates.

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† The sale catalogue of Lambert's library, though seen by Pritzel, is not in any German library. This catalogue states (pp. 19 and 25) that two copies were sold of 1828–37 (£35 and £36), and two copies of 1832 (£4 12*s*. and £3 3*s*.).

As stated below (p. 457), in the 1832 edition, on the unnumbered pages, several species of *Pinus* are described, the number varying in different copies, which appendices may be taken as " fore-runners " of a third volume. In the 1842 edition the appendix contains fourteen species, all of them with a drawing (see p. 461).

The pages and plates in vol. iii are unnumbered; some of them, however, are supplied with a name. Most authors in quoting Lambert have continued the numbering, thereby connecting it with vol. ii of 1828 or of 1832. Pritzel (Ic. Bot. Ind.) again commences with number one, but has pls. 8 and 9 (*P. Coulteri* and *P. serotina*) with an 8, thereby quoting all following numbers incorrectly. Sargent, in his ' Silva of North America,' gives no numbers.

EDITION 1832 (" EDITIO MINOR ").

In 1832 "in conformity with the spirit of the times" (Loudon, Arb. et Frut. i, 188), an edition in octavo was issued, often called " editio minor," with the following title :—A description of the Genus *Pinus*, with directions relative to the cultivation, and remarks on the uses of the several species : also descriptions of many other new species of the family of Coniferæ. Illustrated with Figures. By Aylmer Bourke Lambert. London. Weddell, Prospect Row, Walworth. Ibotson and Palmer, printers. MDCCCXXXII.

This edition, dedicated to William IV, consists of two volumes, continuously paged, sometimes described as 4°., but really nearer to imp. 8°. With a few exceptions, the plates are coloured, bear no number, but for the greater part are named, and referred to, by number, in the text. See contents, p. 456. The copy in Herb. Mus. Brit. has 76 pls. (vol. i, 45 ; vol. ii, 31) ; it has "Some account of etc." (pp. 145–183), but wants the descriptions and pls. 79 and 80 of the eight spp. of *Pinus* at end of vol. ii. The Brit. Mus. copy has 76 pls. (vol. i, 45 ; vol. ii, 31). Vol. ii wants 65 *a* and 66*, but has 79 and 80. The pls. are numbered in MS. The Kew copy (Bibl. Hook.) has 85 pls. (vol. i, 50 ; vol. ii, 35). Pls. [9 *a*], [31 *a*], [34 *a*], [35 *a*], [41 *a*] in vol. i, and pls. [52 *b*] and [56 *c*] in vol. ii are extra ones mainly from the first edition (1803–24), but wants *P. Douglasii* and *dumosa* (Appendix, vol. ii). The text and some of the plates have been inlaid to form two fol. volumes, and some letters from George Bennett to Lambert inserted. The Lindley Library copy has 78 unnumbered pls. (vol. i, 45 ; vol. ii, 33). Other copies seen have 72, 75, 81, 103, 107, and even 111 pls.

Pritzel (Thes. Lit. Bot. ed. i, p. 14) mentions 81 pls. †, presumably from a copy similar to that at Kew, while the ' Bradley Bibliography ' (ii, 12) quotes this edition as 2 vol. 8+183+[5] pp. por. 80 [72] pl. Q. London, 1832.

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† According to Pritzel, in the Royal Library of Berlin " duo adsunt volumina minoris editiorus." Both at the Prussian State Library and at the library of Berlin University we inquired about this copy, but neither of these libraries has the 1832 edition, while the " Auskunftbureau f. d. Bibl. " could not inform us where the copy seen by Pritzel is now.

Some of the plates are re-engravings of parts of, and a few are reductions from, the original ones.

In this edition the Conifers of the former edition are included, along with a number of species, most of them with a plate, not previously described in the first or second editions; also *P. pungens* Lamb., described in 1805 in Ann. of Bot. ii, 198, correcting an error in the letterpress to p. 16 of the first edition; *P. pungens* is not mentioned in vol. ii of 1824 or vols. i or ii of 1828. The new species are not placed at the end of the work, but systematically inserted between the ones treated formerly. In accordance with the altered title, *Quercus*, *Maclura*, *Ilex*, and *Nepenthes* are no longer mentioned.

In many of the species the explanation of the plates is taken over from preceding editions, thereby overlooking that sometimes parts of the plates are omitted. Between the last page of sheet K 2 (p. 144) and the first one of sheet L 2 (p. 145) there is an unnumbered sheet which apparently did not form part of the original work. The order and quantity of pages in this sheet varies in different copies: Kew and the State Library at Stuttgart have 16, the Arnold Arboretum 18; they are wanting in the copy in Herb. Mus. Brit. Then follow the various papers on pp. [145–183] listed on pp. 457–58.

The book ends with four unnumbered pages, giving a table of the species, systematically arranged (pp. [185–188]). The species in the unnumbered sheets are not mentioned. The price of this edition was £12 12*s*. (Loudon, *l. c.* and Pritzel, Thes.), afterwards reduced to £8 8*s*. The 'English Catalogue,' 1801–36 (p. 327), mentions a "new edition," published 1833; this is, no doubt, a misprint for 1832.

EDITION 1837(–42).

In 1837 the second edition (1828–37) was reprinted, and issued with varying title pages, the most complete copy being that in the Department of Botany, British Museum (see p. 458). The titles of vols. i–iii read: A description of the genus *Pinus*, illustrated with figures; directions relative to the cultivation, and remarks on the uses of the several species: also descriptions of many other New Species of the Family of Coniferæ. By Aylmer Bourke Lambert. London: George White, 12 Hatton Garden. MDCCCXXXVII.

In Gordon's 'Pinetum' (1880) a tabulated list (addenda, pp. viii–x) by the editor, H. G. Bohn, is given of all the coloured plates of *Pinus*, in Lambert, Lawson, and Forbes. He quotes "Lambert's Genus *Pinus*; edited by Prof. Don, 3 vols. atlas folio; second and most complete edition, 1837, with 101 coloured plates, and two very large uncoloured ones. These plates being only numbered up to 51, the subsequent ones are numbered in the order of the letterpress." No doubt this list was compiled from H. G. Bohn's own reserved copy, now in Herb. Mus. Brit., offered for £90 in Quaritch's General Catalogue,' 1887 (item 1244, p. 180). A note by Bohn there states: "You may rely upon it, my copy is the best which has ever come to the market, and but for want of room, I should never have parted with it."

Vol. i consists of 1 portr. and 41 pls.; vol. ii, 48 pls.; and vol. iii, 28 pls.; a total of 117 pls. and 1 portr. The numeration of the plates goes from 1–103, but there are no pls. vi, lii–lxvi, or lxix; while there are the following additional ones, viz. i*, xiv*, xxii*, xxxv*, xlii *a–b*, xlv *a–d*, xlvi *a*, *b*, xlvii*, and l *a–b*. The date in the water-mark of the three title pages is 1838, that of some of the text is 1825, while pls. xlvi *b* and lxxi bear that of 1827; pls. i, xii, xiii, xx, lxxxi, and xci, 1838; and save for a few unwatermarked the remainder 1842. In vol. iii all the pages are not numbered, and the plate-numbers are marked in pencil. According to H. G. Bohn (' Lowndes' Bibliographer's Manual,' ii, 1302), an edition in three vols., atlas fol., was issued in 1838, with this title page: Lambert's Description of the genus *Pinus* illustrated with Figures, Directions as to Cultivation and Remarks on the several Species of the Family of Coniferæ. Enlarged by Mr. *Don*. London. Weddell and Bohn, 1838.

Bohn also states that the volumes contain a portrait and 112 beautifully coloured plates, finished and mounted like drawings (£78 15*s*., reduced in 1848 to 40 guineas). This refers to the 1837–42 edition, the title pages bearing the water-mark "1838" (*cf.* 'Notes and Queries,' clviii, 177).

EDITION 1842.

The title pages of vols. i and ii are identical with those of 1832, but with James Bohn as publisher and the date "MDCCCXLII." Those who have seen in the "editio minor" the reproductions of portions of the folio plates, parts of the branches with half needles, some plates folded endlong and cut down to octavo size, and compare these with the magnificent folio plates of 1803–24, will realize that the publisher thought it desirable to issue a better edition in two volumes, consisting of the original plates in a separate volume, and the text of the 1832 edition.

The 'Bradley Bibliography' mentions this edition as: Text xiv+183 pp. 4°. London, 1842. Atlas, por., 88 pl. F. London, 1842, while H. G. Bohn, in his edition of the 'Bibliographer's Manual,' gives correctly 93 pl.; the Arnold Arboretum informs us that their statement "88" is incorrect and should be "99," the larger number being due to the fact that original drawings of *P. Grenvillea*, *maritima*, *tuberculata*, *Coulteri*, and a pencil drawing of *Thuya dolabrata* have been inserted, also a plate of *P. Lemoniana* (pl. 20, Hort. Trans. ser. 2, i, 1835). The frontispiece named, in Catal. Arnold Arb. Lib. 408, as *Salix babylonica*, is, in the Lindley Library copy, the only one available in London, the same as pl. [66*] *Cupressus pendula* in vol. ii of the 1832 edition †, so that the number "93" must remain, the others being added plates.

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† This plate is the right-hand portion of an oblong fol. steel engraving, by W. Alexander, of "The Valley of the Tombs," forming pl. xli of Sir G. L. Staunton's 'Embassy to China,' and mentioned in vol ii (525) of that book as *Cupressus pendula* (*cf.* Bretschneider, Hist. European Bot. Discoveries in China, i, 160). The species also form tab. 43 in the '*Pinus*,' i (1803), the tree in the Valley of the Tombs being referred to on p. 97.

James Bohn placed the "Synoptical Table" at the beginning, after the preface. The contents of the first four pages of this are the same as in the 1832 edition, though the number of plates of the several species is greater; on pp. xiii and xiv, Bohn enumerates the species found on the unnumbered pages, named by him "Appendix," without references to the pages. The number of unnumbered pages between pp. 144 and 145 amounts to 30. Otherwise the text is a re-issue of that of 1832. For this reason, in the statement of contents, the order of subjects on the unnumbered pages is given.

It is important to be able to ascertain which issue an author, who quotes Lambert, has in view, presuming that he really has examined the work. The latter does not appear to be the case with Henkel and Hochstetter ('Synopsis der Nadelhölzer,' 1865), for their quotations, hardly without exception, contain the same inaccuracies as Endlicher ('Synopsis Coniferarum,' 1847). Both speak of first and second editions of Lambert's work, having in view the edition of 1832. Henkel and Hochstetter in their quotations sometimes quote the real second edition (1828).

The quotations of Lambert's work in Lawson's 'Pinetum Britannicum' are inaccurate, Lawson apparently not having seen the work, and there are circumstances which point to a consultation of Carrière's 'Traité général des Conifères.'

Parlatore, in de Candolle's 'Prodromus,' xvi, 2 (1868), quotes the second and third editions, from statements of Carrière and Endlicher, although Endlicher cited the third edition as being the second one.

Koch, in his 'Dendrologie,' ii, 2 (1873), says on p. 255: "Die 1. Auflage des Lambert'schen Coniferen-Werkes steht mir nicht zu Gebote, wohl aber die zweite, in der, wie es scheint, nur eine kolorirte Copie der in der 1. Auflage gegebenen schwarzen Abbildung der *P. taxifolia*" . . . "sich forfindet." But for what reason does he quote for *P. taxifolia* 1st ed. no. 27, t. 33, and for other *Pinus* species also quote the *first* edition? With *P. Webbiana* Koch quotes 2nd ed. 1, 77, t. 44, 1828; but this is really a reference to the "editio minor" (1832), in which the species name is given for the first time (p. 77). Further treating the Conifers, Koch now quotes this, then that, edition, and adds to the statement of *P. sinensis* Lamb. 2nd ed. iii, tab. 2, "aber nicht wie angegeben wird, tab. 29," for correction of a presumed mistake by Parlatore in the 'Prodromus.' Parlatore, however, clearly states *ed.* 3, p. 47, t. 29.

Something like this arises with Beissner ('Nadelholzkunde,' ed. 2, 1909). He does not often quote Lambert, but if he does, his quotations are often wrong; he cites different editions and confuses the dates. With *P. nigra* he notices that in Lambert, i (1803) are the best descriptions and plates, which would point to his having seen the work, but he cites no plate of *P. nigra*, and in his introduction Lambert's work is not mentioned.

Veitch ('Manual of Coniferæ,' ed. 2, 1900), who states, at the end in a list of literature, that vol. i is of 1803, vol. ii of 1824; the second edition of 1828–37, and the third of 1832, probably had only vol. i (1803) at his disposal. His quotations from that volume are correct, the others apparently are for the greater part taken from Endlicher, and are, therefore, mostly wrong.

Elwes and Henry ('Trees of Great Britain and Ireland') mention Lambert's work only occasionally, quoting either the 1803-24 edition or that of 1832 (the latter they call the *second* edition †). No doubt they had seen these editions, but their quotations are incomplete and sometimes inaccurate.

Only Loudon, Endlicher, and Carrière, in their works previously mentioned, apart from a few typographical errors, are reliable.

Loudon quotes the "editio minor," calling it "second edition"; Endlicher always quotes from vols. i and ii of the first edition (1803–24) and the "editio minor" (1832). As before stated, using the last named edition, one must remember that this is called by Endlicher the second, but really is the third.

Both Loudon and Endlicher quote vol. iii, but Endlicher refers to the first edition of that volume. In their numeration of the plates, both commence vol. iii with pl. 82, continuing the numbering from the last plate of the "editio minor," which is unnumbered, but follows a plate numbered 80.

Carrière is the only one who quotes a complete edition of 1828 with the second edition of vol. iii. In the last-named the plates and pages are unnumbered, but he numbers the plates consecutively, following on from pl. 51 of vol. ii, the first plate of vol. iii receiving the number 52, and the first page number 125.

Fr. Antoine, in his 'Die Coniferen nach Lambert, Loudon und Anderen' (Wien, 1840), provides some useful plates and descriptions, and Lambert's '*Pinus*' plates are listed, without numbers, in Catal. Arnold Arb. Lib. vol. i (1914). E. H. Parker, in his article "The Himalayan Silver Firs and Spruces" ('Indian Forester,' liii (1927)), 683–693, gives some useful criticisms of Lambert's plates.

By comparing copies of the various editions with information obtained from several libraries, we have endeavoured to compile a summary in which the contents of each edition are inserted as fully as possible, and from which it is hoped one will be able to trace a quotation from any edition of Lambert's great work.

In the following tables *added* pages and plate numbers are inserted in [ ] :—

EDITION 1803–24.

	VOL. I (1803).	page	tab.
	Preface	i–ii	
	Character genericus	[iii]	
	Synopsis of the species	[iv]	
1.	*P. sylvestris*	[1]–4	i
2.	*P. Pumilio*	[5]–6	ii

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† It is peculiar that, even in Lambert's time, the "editio minor" was called second edition. In "Notices to Correspondents" in Gard. Chron. 1841, 328, answering a query as to the real *Thuja filiformis*, it states that "this plant (see p. 153) is the same as *Thuja pendula* of Lambert's '*Pinus*,' vol. 2, p. 67, of the second edition." Here, again, the third edition must be intended; in other editions that plate bears another number.

EDITION 1803–24 (*cont.*).

VOL. I (1803) *cont*..	page	tab.
3. *P. Banksiana*	[7]–8	iii
4. *P. Pinaster*	[9]–10	iv, v
5. *P. Pinea*	[11]–12	vi, vii. viii
6. *P. maritima*	[13]–14	ix, x [1]
7. *P. halepensis*	[15] 16	xi [4]
8. *P. Massoniana*	[17]	xii
9. *P. inops*	[18]–19	xiii
10. *P. resinosa*	[20]–21	xiv
11. *P. variabilis*	[22]	xv
12. *P. Tæda*	[23]–24	xvi, xvii [2]
13. *P. rigida*	[25]–26	xviii, xix [3]
14. *P. palustris*	[27]–28	xx
15. *P. longifolia*	[29]–30	xxi, xxi [*bis*]
16. *P. Strobus*	[31]–33	xxii
17. *P. Cembra*	[34]–35	xxiii, xxiv
18. *P. occidentalis*	[36]	
19. *P. Abies*	[37]–38	xxv
20. *P. alba*	[39]–40	xxvi
21. *P. nigra*	[41]–42	xxvii
22. *P. rubra*	[43]–44	xxviii
23. *P. orientalis*	[45]	xxix
24. *P. Picea*	[46]–47	xxx
25. *P. balsamea*	[48]–49	xxxi
26. *P. canadensis*	[50]	xxxii
27. *P. taxifolia*	[51]	xxxiii
28. *P. lanceolata*	[52]	xxxiv, xxxiv *bis*
29. *P. Larix*	[53]–55	xxxv
30. *P. pendula*	[56]–57	xxxvi
31. *P. microcarpa*	[58]	xxxvii
32. *P. Cedrus*	[59]–60	xxxvii *bis*
32.**P. Dammara*	[61]–63	xxxviii, xxxviii *bis*
Some account of, etc. (see p. 442)	[65]–86	
APPENDIX.		
Dombeya excelsa	[87]–90	xxxix, lx [*i. e.* xl]
Dacrydium cupressinum	93–94	xli
Cupressus lusitanica	95–96	xxxxii
Cupressus pendula	97–98	xxxxiii
VOL. II (1824).		
P. Pallasiana	[1]–2	1
P. spectabilis	[3]–4	2
P. excelsa	[5]–6	3
P. dumosa	7	–

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[1] In Vol. II, tab. 9 is corrected to *P. Laricio.*

[2] On p. 91 tab. 16 is corrected to *P. pungens.*

[3] According to the explanation of the tables, figs. 1–4 of tab. 19 represent cones of a variety of *P. rigida* and fig. 5 is *P. Tæda alopecuroidea* Hort. Kew.

[4] See note on p. 98.

EDITION 1803–24 (*cont.*).

VOL. II (1824) (*cont.*).	page	tab.
P. Deodora	8	–
Araucaria imbricata	[9]–11	4
Araucaria brasiliana	[12]–13	5
Dammara australis	[14]–16[1]	6
Juniperus squamata	[17]	–
Juniperus uvifera	[17]	–
Cupressus torulosa	[18]	–
Cupressus nootkatensis	[18]	–
Thuja plicata	[19]	–
Thuja chilensis	[19]	–
Podocarpus saligna	[20][2]	–
Podocarpus oleifolia	[20]	–
Podocarpus glomerata	[21]	–
Podocarpus neriifolia	[21]–22	–
Podocarpus macrophylla	22–23	–
Podocarpus pungens	23	–
Taxodium sempervirens	[24]–25	–
Dacrydium taxifolium	25–26	–
Dacrydium distichum	26	–
Quercus grandifolia	27*	8
Pinus Laricio	28*–29*	ix
Pinus maritima	30*	x
Extract from a letter, etc. (see p. 444)	31*	–
Maclura aurantiaca	32*–34*	xii
Appendix by Mr. Don	[27]–40, 40*	–
On the native country of the Potatoe	41–42	–
Ilex paraguensis	[43–45]	11

EDITION 1828–37.

VOL. I (1828).	page	tab.
Portr. of Lambert	–	frontispiece
Pref. to 1st ed.		–
Pref. to 2nd ed.	–	–
P. Lambertiana	–	[no number]
1. *P. sylvestris*	1–4	1, 1 *bis*
2. *P. Pumilio*	5–6	[2]
3. *P. Banksiana*	7–8	[3]
4. *P. Laricio*	9–10	iv
5. *P. Pallasiana*	11–12	[5]
6. *P. maritima*	13	x, *i. e.* [6]
7. *P. halepensis*	14–15	[7]
8. *P. Massoniana*	16	8

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[1] On p. 16 Lambert refers to *P. Dammara* of Vol. I "which I propose to call *Dammara orientalis*."

[2] In the "Additions and Corrections" (II, p. vi) after *Thuja chilensis* are added *Thuja pensilis* and *Thuja pendula*.

EDITION 1828–37 (*cont.*).

VOL. I (1828) (*cont.*).		page	tab.
9.	*P. Pinaster*	17–18	ix, x
10.	*P. Pinea*	19–20	xi, xii, 13
11.	*P. inops*	21–22	14, [14 *bis*]
12.	*P. resinosa*	23–24	15
13.	*P. variabilis*	25	16
14.	*P. Tæda*	26–27	17, 18
15.	*P. rigida*	28–29	19, 20
16.	*P. palustris*	30–31	21
17.	*P. longifolia*	32–33	22
18.	*P. occidentalis*	34	–
19.	*P. Cembra*	35–36	23, 24
20.	*P. Strobus*	37–39	25
21.	*P. excelsa*	40	3, *i. e.* xxvi
22.	*P. Abies*	41–42	27
23.	*P. alba*	43–44	28
24.	*P. nigra*	45–46	29
25.	*P. rubra*	47–48	30
26.	*P. orientalis*	49	xxxi
27.	*P. Picea*	50–51	[32]
28.	*P. balsamea*	52–53	xxxiii
29.	*P. spectabilis*	54–55	2, *i. e.* xxxiv
30.	*P. canadensis*	56	xxxv
31.	*P. dumosa*	57	–
32.	*P. taxifolia*	58	xxxvi
33.	*P. lanceolata*	59	37
34.	*P. Larix*	60–62	xxxvii

VOL. II (1828).			
35.	*P. pendula*	63–64	xxxix
36.	*P. microcarpa*	65	[40]
37.	*P. Cedrus*	66–67	[41]
38.	*P. Deodora*	68–69	42
39.	*Dammara orientalis*	70–72	43
40.	*Dammara australis*	73–75	6, *i. e.* xliv
41.	*Araucaria imbricata*	76–78	45
42.	*Araucaria brasiliensis*	79–80	46
43.	*Araucaria excelsa*	81–83	47
	Some account, etc. (see p. 446)	85–102	–
	Copy of, etc. Extract from, etc.	103–106	–
44.	*Taxodium sempervirens*	107–108	[48 *a*]
[44 *a*].	*Taxodium distichum*	–	–
45.	*Cupressus lusitanica*	109–110	xxxxix
46.	*Cupressus pendula*	111–112	1
47.	*Cupressus torulosa*	113	–
48.	*Cupressus nootkatensis*	113	–
49.	*Thuja plicata*	114	–
50.	*Thuja chilensis*	115	
51.	*Thuja pensilis*	115	–
52.	*Thuja pendula*	115	[50 *a*]

Edition 1828–37 (*cont.*).

Vol. II (1828) (*cont.*).	page	tab.
53. *Juniperus squamata*	116	–
54. *Juniperus uvifera*	116	–
55. *Dacrydium cupressinum*	117–118	li
56. *Dacrydium taxifolium*	119	–
57. *Dacrydium distichum*	120	–
58. *Podocarpus saligna*	121	–
59. *Podocarpus oleifolia*	121	–
60. *Podocarpus glomerata*	121	–
61. *Podocarpus neriifolia*	122	–
62. *Podocarpus macrophylla*	123	–
63. *Podocarpus pungens*	124	–
Extract from letter, etc.	1	–
Thuja dolobrata	2	app
Quercus grandifolia	3	2
Maclura aurantiaca	4–6	3
Ilex paraguensis	7–8, 7*	4
Ilex Martiniana	8*	5
Ilex Gongonha	7**–8**	17, *i. e.* 6
Nepenthes Raffleslana	9	7
Nepenthes ampullaria	10	8
On the native country of the Potatoe	11–12	–
On account of the Lambertian Herbarium	13–30	–
Synoptical Table	[32–35]	–

Vol. III (1837).		
P. Brutia	[1]	[52]
P. sinensis	[3]	[53]
P. pungens	[4]	[54]
P. muricata	[6]	[55]
P. radiata	[8]	[56]
P. tuberculata	[10]	[57]
P. Sabiniana	[12–13]	[58]
P. Coulteri	[15]	[59]
P. serotina	[17]	[60]
P. patula	[21]	[61]
P. Teocote	[22]	[62]
P. leiophylla	[23]	[63]
P. Montezumæ	[25]	[64]
P. canariensis	[27–29]	[65]
P. Gerardiana	[31]	[66]
P. monticola	[33]	[67]
P. Lambertiana	[35–36]	[68, 69]
P. Smithiana	[38–40]	[70]
P. Menziesii	[42]	[71]
P. Douglasii	[44–45]	[72]
P. Fraseri	[47]	[73]
P. nobilis	[49]	[74]
P. bracteata	[51]	[75]
P. Banksiana	[53]	[76]

EDITION 1828–37 (*cont.*).

VOL. III (1837) (*cont.*).	page	tab.
P. grandis	[55]	[77]
P. religiosa	[57]	[78]
Araucaria Cunninghamii	[59–61]	[79]
Taxodium distichum	[63–65]	[80]

EDITION 1832.

	VOL. I (1832).	page	tab.
	Portr. of Lambert	–	frontispiece
1.	*P. sylvestris*	[1]–5	[1 *a*, 1]
2.	*P. Pumilio*	[6]–8	[2]
3.	*P. Banksiana*	[9]–10	[3]
4.	*P. Laricio*	[11]–12	[4]
5.	*P. Pallasiana*	[13]–15	[5]
6.	*P. maritima*	[16]–17	[6]
7.	*P. halepensis*	[18]–19	[7]
8.	*P. Massoniana*	[20]	[8]
9.	*P. Pinaster*	[21]–22	[9]
10.	*P. Pinea*	[23]–24	[10, 11]
11.	*P. inops*	[25]–26	[12*, 12]
12.	*P. resinosa*	[27]–28	[13]
13.	*P. variabilis*	[29]	[14]
14.	*P. Tæda*	[30]–31	[15]
15.	*P. rigida*	[32]–33	[16]
16.	*P. pungens*	[34]	[17]
17.	*P. serotina*	[35]	[18]
18.	*P. patula*	[36]	[19]
19.	*P. Teocote*	[37]	[20]
20.	*P. leiophylla*	[38]	[21]
21.	*P. Montezumæ*	[39]	[22]
22.	*P. occidentalis*	[40]	[23]
23.	*P. palustris*	[41]–42	[24, 25]
24.	*P. longifolia*	[43]–54 [*i. e.* 44]	[26, 27]
25.	*P. canariensis*	[45]–46	[28]
26.	*P. sinensis*	[47]	[29]
27.	*P. Cembra*	[48]–50	[30, 31]
28.	*P. Strobus*	[51]–54	[32]
29.	*P. excelsa*	[55]–56	[33]
30.	*P. Lambertiana*	[57]–58	[34]
31.	*P. Abies*	[59]–60	[35]
32.	*P. alba*	[61]–63	[36]
33.	*P. nigra*	[64]–65	[37]
34.	*P. rubra*	[66]–67	[38]
35.	*P. orientalis*	[68]–69	[39]
36.	*P. Picea*	[70]–71	[40]
37.	*P. balsamea*	[72]–73	[41]
38.	*P. Fraseri*	[74]–75	[42]
39.	*P. religiosa*	[76]	[43]

EDITION 1832 (*cont.*).

VOL. II (1832).	page	tab.
40. *P. Webbiana* [*spectabilis* on plate]	[77]-78	[44]
41. *P. canadensis*	[79]	[45]
42. *P. dumosa*	[80]-81	[46]
43. *P. taxifolia*	[82]	[47]
44. *P. Larix*	[83]-85	[48]
45. *P. pendula*	[86]-87	[49]
46. *P. microcarpa*	[88]	[50]
47. *P. Cedrus*	[89]-92	[51]
48. *P. Deodora*	[93]-95	[52 *a*, 52]
49. *Cunninghamia sinensis*	96	[53]
50. *Dammara orientalis*	[97]-101	[54]
51. *Dammara australis*	[102]-105	[55]
52. *Araucaria imbricata*	[106]-109	[56, 56 *a*, 56 *b*, 57]
53. *Araucaria Brasiliana*	[110]-111	[58, 59, 60]
54. *Araucaria excelsa*	[112]-115	[61, 62]
[55]. *Taxodium distichum*	[116]-119	[63]
[56]. *Taxodium sempervirens*	[120]	[64]
57. *Cupressus lusitanica*	[121]-123	[65, 65 *a*]
58. *Cupressus pendula* [this also forms frontispiece to Vol. I 1842]	[124]-125	[66, 66 *a*]
59. *Cupressus torulosa*	[126]	–
60. *Cupressus nootkatensis*	[126]	–
61. *Thuja plicata*	[127]	–
62. *Thuja chilensis*	[128]	–
63. *Thuja pensilis*	129	
64. *Thuja pendula*	[130]	[67]
65. *Thuja dolobrata*	[131] 132	[68]
66. *Juniperus squamata*	[133]	–
67. *Juniperus uvifera*	[134]	–
68. *Dacrydium cupressinum*	[135]-136	[69]
69. *Dacrydium taxifolium*	[137]	–
70. *Dacrydium distichum*	[138]	–
71. *Podocarpus saligna*	[139]	–
72. *Podocarpus oleifolia*	[140]	–
73. *Podocarpus glomerata*	[141]	–
74. *Podocarpus neriifolia*	[142]	–
75. *Podocarpus macrophylla*	[143]	–
76. *Podocarpus pungens*	[144]	–
Pinus Gerardiana	1 p.	79
Pinus Sabiniana	2 pp.	80
Pinus monticola	1 p.	–
Pinus grandis	1 p.	–
Pinus nobilis	1 p.	–
Pinus Menziesii	1 p.	–
Pinus Douglasii	1 p.	–
Pinus dumosa	1 p.	–
Notes on the Moreton Bay Pine, by A. Cunningham	2 pp.	–

EDITION 1832 (*cont.*).

VOL. II (1832) (*cont.*).	page	tab.
Observations on the coniferous trees of New Zealand, by G. Bennett	5 pp.	-
Botanical characters of several species of coniferous trees of New Zealand	–	-
1. *Phyllocladus trichomanoides*	–	-
2. *Podocarpus ? ferruginea*	–	-
3. *Podocarpus ? Totara*	–	-
4. *Dacrydium ? plumosum*	–	-
5. *Dacrydium excelsum*	2 pp.	-
Some account of, etc.	[145]–176	-
Copy of a letter, etc.	[177]–179	-
Extract from, etc.	[180]	-
Copy of a letter, etc. (see p. 448)	[181]–183	-

EDITION 1837–42.

VOL. I (1837).	page	tab.
Portr. of Lambert, 1829	–	frontispiece
1. *P. sylvestris*	[1]–4	[1], [1 *a*]
2. *P. Pumilio*	5–6	ii
3. *P. Banksiana*	7–8	iii
4. *P. Larico*	9–10	ix
5. *P. Pallasiana*	11–12	i
6. *P. maritima*	13	x
7. *P. halepensis*	14–15	vii
8. *P. Massoniana*	16	viii
9. *P. Pinaster*	17–18	ix–x
10. *P. Pinea*	19–20	xi, xii [marked in pencil 13], [xiii in pencil]
11. *P. inops*	21–22	xiv, xiv *a* [in pencil]
12. *P. resinosa*	23–24	xv
13. *P. variabilis*	25	xvi
14. *P. Tæda*	26–27	xvii, xviii
15. *P. rigida*	28–29	xix, xx
16. *P. palustris*	30–31	xxi
17. *P. longifolia*	32–33	xxii
18. *P. occidentalis*	34	[marked 22* in pencil]
19. *P. Cembra*	35–36	xxiii, xxiv
20. *P. Strobus*	37–39	xxv
[21]. *P. excelsa*	40	[3 corrected in pencil to 26]
22. *P. Abies*	41–42	xxvii
23. *P. alba*	43–44	xxviii
24. *P. nigra*	45–46	xxix
25. *P. rubra*	47–48	[30 in pencil]
26. *P. orientalis*	49	xxxi
27. *P. Picea*	50–51 [marked 52 in error]	xxxii
28. *P. Balsamea*	52–53	xxxiii

EDITION 1837–42 (*cont.*).

Vol. I (1837) (*cont.*).	page	tab.
29. *P. spectabilis*	54–55	2 [corrected in pencil to 34]
30. *P. canadensis*	56	xxxv
31. *P. dumosa*	57	[35 * in pencil]
32. *P. taxifolia*	58	xxxvi
Vol. II (1837).		
33. *P. lanceolata*	59	xxxvii
34. *P. Larix*	60–62	xxxviii
35. *P. pendula*	63–64	xxxix
36. *P. microcarpa*	65	xl
37. *P. Cedrus*	66–67	xli
38. *P. Deodora*	68–69	[42, 42 *a*, 42 *b*, all in pencil]
39. *Dammara orientalis*	70–72	43
40. *Dammara australis*	73–75	44
41. *Araucaria imbricata*	76–78	[45, 45 *a*, 45 *b*, 45 *c*, 45 *d*, all in pencil; 45 *d* is numbered 4]
42. *Araucaria Brasiliana*	79–80	5 [46 in pencil; 46 *a*, 46 *b* also in pencil]
43. *Araucaria excelsa*	81–83	xlvii, xlvi [47 *bis* in pencil]
[blank]	[84]	–
Some account, etc.	85–102	–
Copy of a letter (T. Davis)	103–104	–
Extract from, etc.	104–105	–
Copy of a letter (T. Marsham)	105–106	–
44. *Taxodium sempervirens*	107–108	4 [48 in pencil]
[45]. *Cupressus lusitanica*	109–110	xxxix
46. *Cupressus pendula*	111–112	1 [50 *a* in pencil]
47. *Cupressus torulosa*	113	–
48. *Cupressus nootkatensis*	113	–
49. *Thuja plicata*	114	–
50. *Thuja chilensis*	114	–
51. *Thuja pensilis*	115	–
52. *Thuja pendula*	115	[50* in pencil]
53. *Juniperus squamata*	116	–
54. *Juniperus uvifera*	116	–
55. *Dacrydium cupressinum*	117–118	[51 in pencil]
56. *Dacrydium taxifolium*	119	–
57. *Dacrydium distichum*	120	–
58. *Podocarpus saligna*	120	–
59. *Podocarpus oleifolia*	121	–
60. *Podocarpus glomerata*	121	–
61. *Podocarpus nereifolia*	122	–
62. *Podocarpus macrophylla*	123	–
63. *Podocarpus pungens*	124	–

EDITION 1837–42 (*cont.*).

VOL. II (1837) (*cont.*).	page	tab.
APPENDIX.		
Extract from, etc.	[1]	–
Thuja dolobrata	2	1 [67 in pencil]
Quercus Grandifolia	3	8 [6 in pencil]
Maclura aurantiaca	4–6	[3 in text, 69 in pencil]
Ilex paraguensis	7–8, 7*	11 [70 in pencil, 4 in text]
Ilex Martiniana (plate is marked "*paraguensis*")	8*	[71 in pencil, 5 in text]
Ilex Gongonha	7**–8**	17 [72 in pencil, 6 in text]
Nepenthes Rafflesiana	9	[uncol., 73 in pencil, 7 in text]
Nepenthes ampullaria	10	[uncol., 74 in pencil, 8 in text]
On the native country of the Potatoe	11–12	–
An account of, etc.	13–24	–
Synoptical Table of the Species (Vols. I–II)	[unpaged, 24*a*–25]	–

VOL. III (1837).		
P. Brutia	[1]	[75]
P. sinensis	[3]	[76]
P. pungens	[5]	[77]
P. tuberculata	[7]	[78]
P. radiata	[9]	[79]
P. muricata	[11]	[80]
P. Sabiniana	[13–14]	[81]
P. Coulteri	[15]	[82]
P. serotina	[17]	[83]
P. patula	[19]	[84]
P. Teocote	[21]	[85]
P. leiophylla	[23]	[86]
P. Montezumæ	[25]	[87]
P. Gerardiana	[27]	[88]
P. canariensis	[29–30]	[89]
P. monticola	[31]	[90]
P. Lambertiana	[33–34]	[91, 92]
P. Smithiana	[35–36]	[93]
P. Menziesii	[37]	[94]
P. Douglasii	[39–40]	[95]
P. Fraseri	[41]	[96]
P. nobilis	43	[97]
P. bracteata	45	[98]
P. Pindrow	47–48	[99]
P. grandis	49	[100]
P. religiosa	51	[101]
Araucaria Cunninghamii	53–55	[102]
Taxodium distichum	57–59	[103]
MS. index	[61]	–

EDITION 1842.

VOL. I (1842).	page	tab.
[***Salix babylonica*** ?, or *Cupressus pendula*] (see note, p. 449)	–	frontispiece
Portr. of Lambert	–	–
1. P. ***sylvestris***	[1]–5	[1 *a*, 1 *b*, 1]
2. P. ***pumilio***	[6]–8	[2]
3. P. ***Banksiana***	[9]–10	[3]
4. P. ***Laricio***	[11]–12	[4]
5. P. ***Pallasiana***	[13]–15	[5]
6. P. ***maritima***	[16]–17	6
7. P. ***halepensis***	[18]–19	7
8. P. ***Massoniana***	[20]	8
9. P. ***Pinaster***	[21]–22	9
10. P. ***Pinea***	[23]–24	10, 11
11. P. ***inops***	[25]–26	12*, 12
12. P. ***resinosa***	[27]–28	13
13. P. ***variabilis***	[29]	14
14. P. ***Tæda***	[30]–31	15
15. P. ***rigida***	[32]–33	16
16. P. ***pungens***	[34]	17
17. P. ***serotina***	[35]	18
18. P. ***patula***	[36]	19
19. P. ***Teocote***	[37]	20
20. P. ***leiophylla***	[38]	21
21. P. ***Montezumæ***	[39]	22
22. P. ***occidentalis***	[40]	23
23. P. ***palustris***	[41]–42	24, 25
24. P. ***longifolia***	–	[27, 27 *a*]
25. P. ***canariensis***	[45]–46	[28]
26. P. ***sinensis***	[47]	[29]
27. P. ***Cembra***	[48]–50	[30, 31]
28. P. ***Strobus***	[51]–54	[32]
29. P. ***excelsa***	[55]–56	[33]
30. P. ***Lambertiana***	[57]–58	[34]
31. P. ***Abies***	[59]–60	[35]
32. P. ***alba***	[61]–63	[36]
33. P. ***nigra***	[64]–65	[37]
34. P. ***rubra***	[66]–67	[38]
35. P. ***orientalis***	[68]–69	[39]
36. P. ***Picea***	[70]–71	[40]
37. P. ***balsamea***	[72]–73	[41]
38. P. ***Fraseri***	[74]–75	[42]
39. P. ***religiosa***	[76]	[43]
[39 *a*]. P. ***spectabilis***	–	[43 *a*]
VOL. II (1842).		
40. P. ***Webbiana***	[77]–78	[44]
41. P. ***canadensis*** [*canariensis* on plate]	[79]	[45]
42. P. ***dumosa***	[80]–81	[46]
[42 *a*]. P. ***taxifolia***	[82]	[47 *a* and 48]
43. P. ***Douglasii***	–	[48]

EDITION 1842 (*cont.*).

VOL. II (1842) (*cont.*).	page	tab.
44. *P. Larix*	[83]–85	–
45. *P. pendula*	[86]–87	[49]
46. *P. microcarpa*	[88]	[50]
47. *P. Cedrus*	[89]–92	[51]
48. *P. Deodora*	[93]–95	[52, 52 *a*]
49. *Cunninghamia sinensis* [*Araucaria Cunninghamii* on plate]	96	[53]
50. *Dammara orientalis*	[97]–101	[54]
51. *Dammara australis*	[102]–105	[55]
52. *Araucaria imbricata*	[106]–109	[56, 57, 57 *a*, 57 *b*]
53. *Araucaria Brasiliana*	[110]–111	[58, 59, 60]
54. *Araucaria excelsa*	[112]–115	[61, 62]
[55]. *Taxodium distichum*	[116]–119	[63]
[56]. *Taxodium sempervirens*	[120]	[64]
[57]. *Cupressus lusitanica*	[121]–123	[65]
58. *Cupressus pendula*	[124]–125	[66]
59. *Cupressus torulosa*	[126]	–
60. *Cupressus nootkatensis*	[126]	–
61. *Thuja plicata*	[127]	–
62. *Thuja chilensis*	[128]	–
63. *Thuja pensilis*	[129]	–
64. *Thuja pendula*	[130]	[67]
65. *Thuja dolobrata*	[131]–132	[68]
66. *Juniperus squamata*	[133]	–
67. *Juniperus uvifera*	[134]	–
68. *Dacrydium cupressinum*	[135]–136	[69]
69. *Dacrydium taxifolium*	[137]	–
70. *Dacrydium distichum*	[138]	–
71. *Podocarpus saligna*	[139]	–
72. *Podocarpus oleifolia*	[140]	–
73. *Podocarpus glomerata*	[141]	–
74. *Podocarpus neriifolia*	[142]	–
75. *Podocarpus macrophylla*	[143]	–
76. *Podocarpus pungens*	[144]	–
P. radiata	1 p.	[70
P. muricata	1 p.	[71]
P. Gerardiana	1 p.	79, *i. e.* [72]
P. Sabiniana	2 pp.	80, *i. e.* [75]
P. monticola	1 p.	74
P. grandis	1 p.	75
P. nobilis	1 p.	76
P. Menziesii	1 p.	77
P. tuberculata	1 p.	78
P. Coulteri	1 p.	79
P. bracteata	2 pp.	[80]
P. lanceolata	[no text]	[81]
Araucaria Cunninghamii	3 pp.	[82]
P. Brutia	2 pp.	[83]
P. Pindrow	1¼ pp.	[84]
P. Smithiana	[no text]	[85]
Observations on coniferous trees, etc.	4¼ pp.	–

EDITION 1842 (*cont.*).

VOL. II (1842) (*cont.*).	page	tab.
Botanical characters of, etc.	¾ p.	–
Notes on Moreton Bay Pine	2 pp.	–
Some account, etc.	[145–176]	–
Copy of a letter, etc.	[177–179]	–
Extract from, etc.	[180]	–
Copy of a letter, etc.	[181–183]	–

COPY AT LINNEAN SOCIETY.

		tab. marked.	Source.
	Portr. of Lambert	–	i. 1828
	t. p. 1828	–	i. 1828
	Dedication to Sir R. C. Hoare	–	i. 1828
	[1 p. blank]	–	–
	Preface	–	i. 1828
	Additions and corrections	–	ii. 1824
	P. Lambertiana	–	i. 1828
	Preface to 2nd edition	–	i. 1828
	P. Pallasiana	5	i. 1828
	P. spectabilis	2	ii. 1824
	P. excelsa	3	ii. 1824
	P. Deodora	42	ii. 1828
	P. dumosa	–	ii. 1824
	Araucaria imbricata	4	ii. 1824
	Araucaria brasiliana	5	ii. 1824
	Dammara australis	6	ii. 1824
	Dammara orientalis	43	ii. 1828
	Juniperus squamata	–	ii. 1824
	Juniperus uvifera	–	ii. 1824
51.	*Thuja pensilis*	–	ii. 1828
52.	*Thuja pendula*	–	ii. 1828
49.	*Thuja plicata*	–	ii. 1828
50.	*Thuja chilensis*	–	ii. 1828
	Podocarpus saligna	–	ii. 1824
	Podocarpus oleifolia	–	ii. 1824
	Podocarpus glomerata	–	ii. 1824
	Podocarpus neriifolia	–	ii. 1824
	Podocarpus macrophylla	–	ii. 1824
	Podocarpus pungens	–	ii. 1824
	Taxodium sempervirens	–	ii. 1824
	Taxodium distichum	–	ii. 1828
	Dacrydium taxifolium	–	ii. 1824
	Dacrydium distichum	–	ii. 1824

APPENDIX.

Extract from a letter, etc.	–	ii. 1828
Thuya dolobrata	1 app.	ii. 1828
Quercus grandifolia	8	ii. 1824
P. Laricio	4	i. 1828
P. maritima	x	ii. 1824
Cupressus torulosa	–	ii. 1824

COPY AT LINNEAN SOCIETY (*cont.*).

	tab. marked.	Source.
APPENDIX.		
Cupressus nootkatensis	–	ii. 1824
Maclura aurantiaca	xii	ii. 1824
Ilex paraguensis	4	ii. 1828
Ilex Martiniana	5	ii. 1828
Ilex Gongonha	17	ii. 1828
Nepenthes Rafflesiana	7	ii. 1828
Nepenthes ampullaria	8	ii. 1828
Appendix by Mr. Don, etc.	–	ii. 1824
[1 p. blank]	–	–
On the Native Country, etc.	–	ii. 1824
Synoptical Table	–	ii. 1828

OTHER PUBLICATIONS OF LAMBERT.

Account of the *Canis Graius Hibernicus*, or Irish Wolf Dog, described in Pennant's History of Quadrupeds, 3rd edit. vol. i, p. 241. Linn. Soc. Trans. iii, 16. 1797.

A description of the genus *Cinchona*, comprehending the various species of vegetables, from which the Peruvian and other barks of a similar quality are taken. Illustrated by figures of all the species hitherto discovered. To which is prefixed Prof. Vahl's Dissertation on this genus, etc. 4°. London, 1797. (Ferd. Bauer's drawings for pls. 4, 5, and 7–12 are inserted in the copy in Herb. Mus. Brit.)

Anecdotes of the late Dr. Patrick Browne, author of the 'Natural History of Jamaica.' Linn. Soc. Trans. iv, 31, 1798.

Description of the Blight of Wheat, *Uredo Frumenti*. *Ibid.* 193, 1798.

Beschreibung der *Hyænanche globosa*. Römer Archiv Bot. ii. 398, 1801.

Description of *Bos Frontalis*, a new species from India. Linn. Soc. Trans. vii, 57, 1804, plate by Cruikshank.

Observations on the *Zizania aquatica*. *Ibid.* 264, 1804.

Further account of *Bos Frontalis*. *Ibid.* 302, 1804.

On a new species of *Pinus* [*P. pungens*]. Ann. of Bot. ii, 198, 1805.

Description of a new species of *Macropus* [*M. elegans*] from New Holland. Linn. Soc. Trans. viii, 318, 1807.

Some Account of the Herbarium of Professor Pallas. *Ibid.* x, 256, 1811.

Notes relating to Botany collected from the manuscripts of the late Peter Collinson, Esq. *Ibid.* 270, 1811.

Description of a new species of *Psidium* [*P. polycarpon*]. *Ibid.* xi, 231, 1815.

On the Native Country of the Potato, and on some American Plants. Quart. Journ. Sci. x, 25, 1821 (*cf.* Bot. Miscellany, ii, 202. Additional note by Lambert in Edin. New Phil. Journ. iii, 192, 1827).

An illustration of the genus *Cinchona*; comprising descriptions of all the officinal Peruvian Barks, including several new species; Baron de Humbolt's account of the Cinchona forests of South America, and Lambert's Memoir on the different species of Quinquina. . . . 4°. London, 1821.

An historical eulogium on Don Hipolito Ruiz Lopez, first botanist and chief of the expedition to Peru and Chile, [etc.] (translated from the Spanish), ed. by A. B. Lambert. 8⁰. Salisbury, 1831.

Some Account of the Galls found on a Species of Oak from the Shores of the Dead Sea. Linn. Soc. Trans. xvii, 445, 1836.

Notes of the Mustard Plant of the Scriptures. *Ibid.* 449, 1836.

Some Account of the Apples of Sodom or the Galls found on a species of Oak from the shores of the Dead Sea. Edin. New Phil. Journ. xxxii, 20–24, 1842.

Lambert was also "the real editor" of Pursh's 'Flora Americæ Septentrionalis,' 1814 (*cf.* 'Reliquæ Baldwinianæ,' 196, 1843).

APPENDIX.

Extracts from the Smithian Correspondence.

By SPENCER SAVAGE.

LAMBERT to JAMES EDWARD SMITH.

1798, January 3rd.

" . . . I have shewn Sir J. Banks the Drawings of the *Pini* which he seemed very much to approve of & has been kind enough to undertake the direction of the Engravings as he thinks some of the Drawings are on too large a scale. He has pointed out what he thinks proper to be Figured. As you was so kind to offer me your assistance I shall let the MS. rest a little till we meet. . . "

1801, March 2nd.

" I should have sent you plates of all the Pines, and the Ericæ, which I promised; but am waiting till Warner [*the engraver*] has finished the last two plates which he has now got and I hope will be soon done. I then shall intreat your assistance, — will send you all the specimens and MSS. &cc., but I wish to wait for the next volume of La Marck, which I expect very soon and which will contain the Pines, and where I hope to find something about *Pinus orientalis,*— a plate of the Cones I think I have already got from China. I long to shew you the plate of the *Pinus sylvestris,* which you might quote in the Flor: Brit: I paid Warner twelve Guineas for the engraving of it. Nothing I believe can be much better finished. Sir J. was much pleased with it. . . "

1803, September 27th.

" . . . I have at last got a Copy of *Pinus* and have desired a Coloured one for you to be done as soon as possible and which I hope you will soon receive. You will be so good as to order from Whites [*the publishers*] what others you wish. . . "

1803, November 23rd.

"... Mr. White sent me your Letter yesterday and am sorry we should give you so much trouble, but which I hope your goodness will excuse. There is one part which you mention relating to Mr. White's profits; you were not aware perhaps that I gave him leave to have 25 copies coloured, which he sells at forty Guineas each ! & on which I get only one Guinea's profit each; if I understand him right: but perhaps I have not stated the case right and I was in a hurry yesterday when I saw him. We have fixed the price of the plain ones at ten Guineas, as every one says they are at least worth that.

"I shall have only 175 copies to sell which I shall clear by eight hundred pounds, to repay me fourteen hundred pound; then I have the Drawings and the Copper plates, which I reckon at two hundred pound, so that I shall be about four hundred pounds *Minus*... Sir J. Banks told Dr. Whyne in my presence it was the finest work ever published..."

1804, January 25th.

"... I am rather surprised Mr. White has not yet sent you the *Pinus*. Hooker is so busy he told me long before your last letter that he could not get any more done till after Christmas but surely he might have got one before this time, and I think your friend Mr. White ought to have sent it long ago ... but there is this advantage you both [*Maton and Smith*] will derive from it, that those now doing are on muchbetter paper ! and I suppose a few days must bring it you..."

1804, February 27th.

"... I trouble you with these few Lines to say that Mr. White will have some Copies of Pinus delivered to him this Day by Mr. Hooker who colours them..."

A Revision of the British Euphrasiæ.

By H. W. Pugsley, B.A., F.L.S.

(Plates 26–37.)

[Read 2nd May, 1929.]

In modern botany the genus *Euphrasia* has been generally restricted to the Section *Euphrasium* Duby, Bot. Gall. i, 354 (1830), which alone is dealt with in the monograph of Dr. R. von Wettstein, and of this Section the Group *Eu-Euphrasia* Wettst. Subsect. *Semicalcaratæ* (Benth.) only is represented in these islands. The genus, thus restricted, includes two Linnean species, *E. officinalis* and *E. tricuspidata*, both belonging to the *Semicalcaratæ*. These two plants exist in the Linnean Herbarium, the sheet of the former showing three specimens, of which two are the glandular *E. Rostkoviana* Hayne, and the third an eglandular form that has been referred to *E. nemorosa* Pers. but is more probably the Scandinavian *E. curta* Fr. *E. tricuspidata* is represented by a single unmistakable example. Since the time of Linnæus a number of further forms have been distinguished on the Continent as species or varieties, notably *E. alpina* Lamk. in 1786, *E. salisburgensis* Funck in 1794, *E. minima* Jacq. in 1800, *E. nemorosa* Persoon in 1807, *E. gracilis* Fries in 1818, *E. Rostkoviana* Hayne in 1825, *E. curta* Fries in 1828, and *E. stricta* Host in 1831. In 1852 seven species were published by A. Jordan in his ‘ Pugillus,’ but of these two only are now admitted as new. More recently other species have been established by Freyn, A. Kerner and other European botanists.

In Nyman's ‘ Conspectus,’ iii, 551 (1881), most of these names are brought together under five species, *E. officinalis* L., *E. minima* Schleich., *E. gracilis* Fr., *E. salisburgensis* Funck, and *E. tricuspidata* L., but the way in which they are grouped indicates little knowledge of the plants' affinities.

In 1896 the monograph of Dr. Wettstein appeared, and here all the known forms of the Section *Euphrasium* are exhaustively dealt with and many new species described. Wettstein divides his genus into two Sections: (1) *Eu-Euphrasia*, comprising two Subsections, *Semicalcaratæ*, the Eyebrights of the Northern Hemisphere, and *Australes*, plants of Australia and New Zealand; and (2) *Trifidæ*, the South American Eyebrights. Eighty-seven species are described, of which fifty-four belong to the *Semicalcaratæ*. The descriptions (all in Latin) are of uniform excellence.

Wettstein divides the *Semicalcaratæ* into three series: (1) *Parvifloræ*, having leaves not more than twice as long as broad, margin of capsule ciliate, and corolla-tube not finally elongate; (2) *Grandifloræ*, with leaves and capsule as in (1), but corolla-tube finally elongate; and (3) *Angustifoliæ*, having leaves 2–30 times as long as broad, lanceolate or linear, and corolla-tube finally elongate or not. In a preliminary chapter the origin of these groups and their respective species is discussed at some length. Excepting a few species whose origin he considers problematical, Wettstein attributes the larger-flowered forms of the *Parvifloræ* to a single early ancestor, which he names *E. palæo-pectinata*, and the smaller-flowered plants of this series to another early ancestor, allied to *E. latifolia* Pursh, which he designates *E. palæo-nemorosa*. The *Grandifloræ* he considers to have a separate origin, and to be derived from two ancestors, *E. palæo-Rostkoviana* and *E. palæo-alpina*, for the glandular and glandless groups respectively. The origin of the *Angustifoliæ* is ascribed to a primordial *E. palæo-tricuspidata*.

An analytical clavis of the species is given, but no attempt is made to show their relationships within their respective series. A table in which the European forms are arranged as collective species, species of first rank, and species of second rank, was published by Wettstein in Œsterr. Bot. Zeit. for November 1896. The monograph does not show varieties as such, but it includes a number of hybrids.

A second important work on the genus is 'Les Euphrasia de la France,' by Alfred Chabert, which appeared in Bull. Herb. Boissier for 1902. Chabert's treatment of these plants differs materially from Wettstein's. He maintains that species in the Linnean sense do not exist among the *Euphrasiæ Semicalcaratæ*, and that there are only forms or races, for which he adopts the name of "micromorphe." These "micromorphes" he groups according to their affinities, each group including a recognized species, to which are attached others of kindred character, each bearing a second trivial name. In this way Chabert describes twelve species for France, to most of which one or more additional "micromorphes," under trinominal names, are appended. Wettstein's three series, *Parvifloræ*, *Grandifloræ*, and *Angustifoliæ*, are not adopted. In his prefatory chapter Chabert discusses the great variability of the forms of *Euphrasia* and the prevalence of intermediates, which often he would not attribute to hybridity, but rather to an innate tendency to variation; and he points out how, while a collection of selected specimens in the herbarium may indicate a number of good species, the plants actually met with in the field may be much less distinct. The development of any hypothesis of ancestral types he rejects as too liable to lead to the domain of fantasy. Chabert's "micromorphes" are generally admitted as varieties in Rouy's 'Flore de France,' xi, 143 *sqq.* (1909).

The latest detailed account of *Euphrasia* to be published is "Die Euphrasia-Arten Norwegens," by E. Jørgensen, in 'Bergens Museums Aarbok' (1919), written in German with a brief summary in English. This author describes ten species as Norwegian, with numerous varieties. Like Chabert he points out that these species differ from each other only in degree and not in definitely distinct characters; but he attaches greater importance to hybridisation in the evolution of species. Jørgensen modifies Wettstein's classification by adopting two series only, *Angustifoliæ* and *Ciliatæ*, the latter of which is divided into three subseries, *Minorifloræ*, *Majorifloræ*, and *Grandifloræ*. The first two of these subseries represent Wettstein's *Parvifloræ*. Jørgensen's descriptions of the species and varieties are by far the most complete that have been written, and are illustrated not only by plates but by useful text-figures.

The Eyebrights remained neglected in Britain almost till the end of the last century, and in the third edition of Hooker's Student's Flora (1884) one species only is recognized, viz. *E. officinalis* L., with two varieties, *E. gracilis* Fr., and var. *maritima*, from the shores of Shetland. The first British botanist to study the group was Frederick Townsend, who in 1884 wrote an interesting account of *E. officinalis* L. (Journ. Bot. xxii, 161 *sqq.*). In this paper Townsend set forth the view that all the European forms of *E. officinalis* belong to a single polymorphic species, which he divides into eight groups of subspecies and varieties—*Officinales*, *Alpinæ*, *Tricuspidatæ*, *Nemorosæ*, *Graciles*, *Salisburgenses*, *Parvifloræ*, and *Minimæ*. Of these groups he furnishes diagnostic characters, and expresses a hope that an account of the subspecies &c. will follow at a future date. This work, which seems to have been the earliest attempt to group the European *Euphrasiæ*, shows a good general knowledge of their forms, and it is to be regretted that it was not completed as intended. Townsend's presence in Parliament between 1886 and 1892 was perhaps the cause of this, and a letter of his of this period at Kew expresses his regret at the compulsory curtailment of his botanical work. In 1890, however, Townsend described (Journ. Bot. xxviii, 162 *sq.*) a new Swiss subspecies, *E. capitulata*, which Wettstein subsequently identified with *E. drosocalyx* Freyn, and the following year (*l. c.* xxix, 161) a new form from Scotland, *E. paludosa* (*E. scotica* Wettst.). In 1896 he added *E. salisburgensis* Funck to the British list (*l. c.* xxxiv, 441). In 1897, when Townsend was seventy-five years old, he published in Journ. Bot. xxxv, 321 *sqq.* a "Monograph of the British species of *Euphrasia*," not based on his earlier paper, but adapted from Wettstein's work of the previous year. This monograph is only partially original. The first part deals with morphology, evolution and formation of species, and is an abridged translation from the German of Wettstein. The second part—Description and distribution of species &c.—contains Wettstein's Latin diagnoses of the species identified as British, with an abridgment of his synonymy, distribution, &c., and supplemented by a list of British localities and original critical remarks. The diagnoses do not seem always to have been collated with British material. In this work fourteen British species are admitted, *E. stricta* Host, *E. borealis* Towns., *E. brevipila* Burnat & Gremli, *E. nemorosa* H. Mart., *E. curta* Fr., *E. occidentalis* Wettst., *E. latifolia* Pursh, *E. foulaensis* Towns., *E. gracilis* Fr., *E. scotica* Wettst., *E. Rostkoviana* Hayne, *E. campestris* Jord., *E. Kerneri* Wettst., and *E. salisburgensis* Funck; and six hybrids are also given. Townsend's monograph has been regarded as an authoritative account of the genus in Britain, and a synopsis of it was inserted in the ninth edition of Babington's Manual (1904). In 1898 Townsend described a new North American species, *E. canadensis*

(Journ. Bot. xxxvi, 1), and in 1902 (Ann. Scott. Nat. Hist. 177) a new form *piccola* of *E. curta*.

The appearance of Townsend's monograph drew the attention of British botanists to the genus, and in the succeeding years *Euphrasiæ* were largely collected, particularly by the late E. S. Marshall and W. H. Beeby in Scotland. Most of the material obtained before Townsend's death in 1905 was submitted for his opinion. Shortly afterwards, in 1907, a violet-flowered form resembling *E. Rostkoviana* was described by the late F. H. Davey as a new species, *E. Vigursii* (Journ. Bot. xlv, 217); and two years later (*l.c.* xlvii, 165 *sq.*) the little Exmoor Eyebright, whose flowers are often yellow, was identified with *E. minima* Jacq. in an elaborate paper by the late W. P. Hiern. A further contribution to the study of the genus was Dr. E. Drabble's paper in Journ. Bot. liv, 73 (1916), in which a form of *E. nemorosa* with slightly hirsute leaves was distinguished as a variety *ciliata*.

This more recent work is reflected in a second account of the genus in Britain by the late Cedric Bucknall (Journ. Bot. lv, Supplement (1917)). This author endeavours to make use of fresh diagnostic characters to distinguish the species without introducing anything at variance with the descriptions of Wettstein and Townsend, the new features being mainly connected with the habit of the plant. Bucknall does not adopt any generic subdivisions, and remarks that the length of the corolla is unreliable as a distinctive character, at least in the British species. His species are the same as Townsend's, with the addition of *E. cærulea* Tausch, *E. suecica* Murb. & Wettst., *E. Vigursii* Davey, *E. minima* Jacq., and *E. fennica* Kihlman ; and five new varieties are created . Analytical keys but only partial diagnoses of the species are furnished, and much of the work is devoted to an account of the peculiarities of plants of various individual localities.

Still more recent are my own papers on this genus in Journ. Bot. lvii, 169 *sq.* (1919) and lx, 1 *sq.* (1922). The first demonstrates that the Exmoor *E. minima* is not the plant of Jacquin and renames it *E. confusa* ; and adds *E. hirtella* Jord. to the British list. The second extends the definition of *E. confusa*, and gives reasons for rejecting *E. stricta* as a British plant.

In addition to these works on *Euphrasia* there are numerous critical notes in the Reports of the two Exchange Clubs, among which are descriptions of three further presumed new species. A perusal of these Reports at once reveals that great differences of opinion still obtain touching many of our British forms, despite the work of Townsend and his successors; and with this in view the present Revision has been attempted after an examination of all the *Semicalcaratæ* material at Kew, British Museum, and Manchester, the collections of Townsend, Beeby, and Bucknall, as well as Mr. Barton's and my own herbaria. Altogether over five thousand sheets have been dealt with. The British *Euphrasia*-forms are complicated and often difficult to understand, and in order to grasp them adequately a fair acquaintance with the *Semicalcaratæ* as a whole group, and of all its described forms, is a first essential.

MORPHOLOGY.

Habit.

While every form of *Euphrasia* is capable of considerable variation in habit as it is more or less well developed, yet many forms present special features which seem to be characteristic. Two of the most distinct types of growth are those induced by the seasonal dimorphism described and illustrated by Wettstein (Mon. p. 44). In the first of these, the æstival or early-summer form, of which *E. montana* Jord. is an example, the internodes are very long, even the first pair of leaves being placed at some distance above the cotyledons, and the first flowers are generally produced with the fourth pair. The plant thus possesses only three pairs of leaves in whose axils branches can develop, and therefore must remain slightly, if at all, branched, with few leaves and conspicuously long internodes below. The corresponding autumnal or late-summer form, like *E. Rostkoviana*, has the first internodes very much shorter, and no flowers are normally produced before the fifth, and sometimes not till the twelfth pair of leaves, or even later. This gives a much greater opportunity of branching, and as the same habit tends to continue in the branches, there is a further possibility of secondary branches being thrown out. The plant is thus capable of becoming much branched and many leaved, and owing to its shorter internodes the branches will begin much nearer the base of the stem. Species of northern latitudes, such as *E. latifolia*, and also *E. minima* of Central Europe, generally resemble the early-summer forms in habit, though sometimes with shorter internodes, or are unbranched; and owing to the brief summers of their habitats, they usually have no distinctly corresponding late-summer forms. In *E. latifolia* and *E. minima* the first flowers sometimes appear with the second pair of leaves, and above the fourth only in luxuriant individuals. Any branches developed must therefore spring from near the base of the stem, and in *E. minima* they are sometimes produced from the first pair of leaves. There are other variations of habit, as appears in *E. gracilis*, which commonly develops six or eight pairs of leaves before it flowers and produces branches only in the axils of the highest of these. Among the British species, some, like *E. nemorosa*, are late-summer forms, capable of considerable branching, and others, such as *E. brevipila*, are of somewhat intermediate habit. On the sea-coast, particularly in the North of Scotland, and occasionally also on mountains, condensed forms occur, which, while more or less branched, have suppressed internodes, and often finally are only an inch or two in height. This condition is probably in most cases a result of exposure to wind, and dried specimens are often difficult to identify. Exsiccata of this kind are rare in the herbaria examined, except from Great Britain. It should be remembered that weak unbranched individuals of the normally branched forms can nearly always be found in any colony of Euphrasias, and that a condensed capitate condition is sometimes due not so much to exposure as to injury through nibbling by sheep or rabbits.

Euphrasias of the early-summer type, or approximating thereto, are usually of slender growth, though nearly erect in their branches as well as the main stem.

Exceptions to this rule are the widely-spread *E. pectinata* Ten. and *E. hirtella*, both of which are fairly robust. Most of the late-summer forms are relatively stout and strict in habit, some with erect and others with spreading branches. In the late-flowering *E. Rostkoviana*, however, both stem and branches are relatively slender and flexuous.

Foliage and hair-clothing.

The foliage of the Eyebrights is variable like the habit, and often furnishes specific characters. Most of the leaves bear flowers in their axils, and are then termed bracts by Wettstein and Townsend. This term is convenient, but is morphologically incorrect, for the floral leaves are indeed the most highly-developed ones, and are in no sense modified or reduced leaves subtending the flowers of a raceme or spike. They will therefore be mentioned not as bracts but as floral leaves.

The cotyledons in *Euphrasia* are round or ovate, glabrous and entire, and the earliest pair of true leaves commences a transition towards the form of foliage characteristic of the species. In the early-summer forms, where leaves are few, this transition is rapid ; in the late-summer forms, with more abundant foliage, the transition is more gradual. The first pairs of leaves are always opposite, but the later ones become sub-opposite or alternate, especially in some late-flowering forms. The fully developed type of leaf is usually reached where the flowers begin, and may continue almost to the apex of the stem, but frequently the upper floral leaves again change in form, although they do not revert to that of the lower stem-leaves. Characteristic diagnostic features are generally best shown in the lowest floral leaves. In some branched species, as *E. brevipila* and *E. nemorosa*, the highest cauline leaves below the first flowers are often distinctly larger than any that succeed them, while in others, like *E. anglica*, the floral leaves are normally the largest. In all branched forms the leaves of the branches are smaller and narrower than those of the main stem, as might be expected. In the early-summer forms the lowest floral leaves usually fully equal those below them, and in *E. latifolia*, when well grown, they are sometimes notably larger. The nature of the leaf-cutting is best shown in the lower floral leaves, where it normally reaches its maximum. These leaves are usually broader than those below or above them. On an average the teeth of the leaves are sharper in the late-summer species.

The hair-clothing of the foliage and of the calyx, which is mostly similar, may consist of simple hairs only, or a mixture of simple and glandular hairs. It is extremely variable, sometimes even in forms that resemble each other in other respects and are regarded as belonging to a single species, *e.g.* in *E. minima*. A few species like *E. stricta* are normally glabrous except the stem. Simple foliage hairs are often minute and scarcely visible without a lens, but they may be stout-based bristles, 1 mm. in length, as in *E. tatarica* Fischer, or equally long, finer, waved hairs, as in *E. curta*. The glandular hairs of such species as *E. Rostkoviana* are 2–5-celled, jointed and of variable length, some exceeding 1 mm. ;

or they may be straight, 1-celled, and much shorter, as in typical *E. brevipila.* Wherever glandular hairs occur they are usually more or less intermingled with simple ones. The hair-clothing, whatever its nature, is best seen about the base and margins of the lower floral leaves, and on the nerves and teeth of the calyx ; it may spread over the upper foliar surface, chiefly towards the margins, and along the nerves of the underside ; or it may sometimes clothe the whole upper and lower surfaces of the leaves. In the case of glandular species this character of the hairs may spread to the stem and branches. It is noteworthy that in the normally glandular forms the characteristic hairs may sometines become few or occasionally even obsolete ; and glandular hairs are occasionally found, but possibly only through hybridity, in forms that are commonly eglandular.

Flowers.

As in many other annuals, the latest flowers towards the apex of the stem are sometimes relatively small and ill developed. The finest and most characteristic flowers are generally those that open first.

Calyx.

The form of the calyx-teeth is homologous, as a rule, with that of the leaf-toothing, just as the calyx corresponds with the foliage in hair-clothing. In some species, *e.g.* in *E. borealis*, the calyx becomes markedly accrescent in fruit.

Corolla and fertilisation.

The corolla is important for the determination of species, and was a principal feature considered by Wettstein in fixing a basis for the three groups of his Subsection *Semicalcaratæ*. The chief criterion is the corolla-tube. According to the monographer, this tube does not elongate between the opening of the flower and its fertilisation in the thirty-two species of his group *Parviflorœ*, while it does elongate during this period in the twelve species of his *Grandifloræ.* The observations of Chabert lead to a different conclusion, and he considers that the tube lengthens in all Euphrasias, though not very appreciably in most of Wettstein's *Parvifloræ*. Townsend expresses the same view as Wettstein, while Bucknall thought the length of the corolla variable even in a single species and unreliable as a distinctive character, and described it rather curiously as " large, small or conspicuous."

My own experience at home and abroad tends to confirm, with some modifications, the views of Wettstein. In all Eyebrights the whole corolla apparently continues to grow, after first opening, until the dehiscence of the anthers, this growth involving some elongation of the corolla-tube. In the *Parvifloræ* the growth of the tube is generally proportionate to that of the lips, and when it ceases, the tube does not appreciably exceed the calyx-teeth. There are probably some modifications of this rule, and I believe that a relatively greater elongation of the tube commonly takes place in very small flowered plants like *E. minima.* In Wettstein's *Grandifloræ* the elongation of the tube is greater than that of the remainder of the corolla, so that at maturity the tube obviously exceeds the calyx-teeth and the corolla becomes distinctly exserted. It may be doubted whether the degree of elongation is the same in all the species of the *Grandifloræ*, or indeed in all the individuals of any one species, but a distinct elongation appears to be a constant feature in the plants that Wettstein has brought together under this group. Among European species it is particularly marked in *E. Rostkoviana* and *E. Kerneri*.

The size of the corolla as a whole is also important for affording diagnostic characters. Wettstein's dimensions are taken from the base of the corolla-tube to the apex of the upper lip, and his lengths (with very few exceptions) are therefore greatest for the species of the *Grandifloræ* owing to the elongation of the tube. But the flowers in this group are not always really larger or more conspicuous than those of certain of the *Parvifloræ*. The size of the corolla chiefly depends upon the development of the lips, especially of the lower one, and in such species as *E. suecica*, *E. brevipila*, and *E. borealis*, included in Wettstein's *Parvifloræ*, it sometimes equals the flowers of the *Grandifloræ*, though, owing to the shorter tube, it is less exserted. It is to such flowers as these that Bucknall presumably intended to apply the term "conspicuous."

Although subject to much variation, the colour of the corolla often furnishes some indication of the species. White flowers are typical of *E. Rostkoviana* and *E. nemorosa*, lilac ones of *E. stricta* and *E. brevipila*, and *E. minima* is noted for its yellow hue.

My observations on fertilisation in the genus accord, so far as they go, with those of Wettstein, but I have no personal records of insect visitors. I am inclined to think that even among the *Grandifloræ* autogamy frequently takes place. In the different forms there appears to be a complete gradation in the conditions of fertilisation, ranging from the typically proterogynous flowers of the *Grandifloræ* to the almost exclusively autogamous flowers of such species as *E. gracilis* and *E. minima*. In some large-flowered species of the *Parvifloræ*, as seen in Britain, on the flower opening, the slightly decurved style protrudes with ripe stigma in front of the upper corolla-lip above the unopened anthers, and xenogamy only is then possible. But as the corolla develops, the anthers are carried forward and upward before dehiscence till they reach the stigma, which at that stage is sometimes withered, but sometimes still capable of fertilisation. Autogamy may then happen. This process is almost identical with what obtains in *E. Rostkoviana*, as described by Wettstein, except that the style is somewhat less straight and horizontal in the British form, and is consequently reached by the anthers more quickly. In *E. nemorosa* the style is still more decurved on the flower opening, and so closer to and more directly in front of the anthers. Autogamy here soon becomes possible as the corolla expands. This approaches the condition of *E. minima*, where the stigma and anthers are both ripe and in contact very soon after the opening of the flower.

The suggestion that the species of the *Grandifloræ* affect regions where insect-life is abundant and that small-flowered species inhabit districts where it is scarce, does not seem entirely correct. In Spain and Italy, away from the Pyrenees and the Alps, no *Grandifloræ* are to be found, but several species of the *Parvifloræ*. In the higher Alpine regions *E. alpina* grows as well as *E. minima*, and at lower elevations *E. Rostkoviana* with *E. stricta* or *E. nemorosa.* In Scotland *E. gracilis* may be seen in company with large-flowered forms of *E. brevipila.* And in Scandinavia, although small-flowered species only, like *E. latifolia*, inhabit the far north, yet a little to the southward are the very large flowered *E. suecica* and others. Very large- and very small-flowered forms are frequent in Shetland.

Capsule.

Important diagnostic characters are furnished by the capsule. While in most species its margins are ciliate with long, stiff hairs, in *E. salisburgensis* and some other members of the *Angustifoliæ* this ciliation is normally wanting. This distinction, however, is not an absolute one. The shape of the capsule, though variable within certain limits, is very characteristic. In *E. pectinata* it is relatively long and narrow, with a rounded apex; in *E. hirtella* it is broader and more elliptical, and apically retuse or emarginate. In some boreal species the capsule grows to a large size. Jørgensen makes a diagnostic feature of the size of the seeds, which, he says, vary in length from 1 mm. to 2 mm. in different Scandinavian forms. I have been unable to confirm this by observation, for the British forms that I have tested have shown considerable variation.

ORIGIN OF SPECIES.

The species of *Euphrasia*, Subsect. *Semicalcaratæ*, are generally ill-defined and in great measure differ from each other, as Jørgensen remarks, only in degree and not in definitely different characters. It is therefore necessary, in examining any form, to consider its ensemble of characters rather than to rely on any one distinctive feature as a means of segregation. The plants which Wettstein defines as species usually possess a definite ensemble of characters and a more or less extensive geographical distribution. Specimens of *E. gracilis* from Scandinavia, France, and Britain, or examples of *E. brevipila* from the Alps, Scandinavia, and Scotland bear such a distinct resemblance in their aggregate features that one is forced to regard them as fixed types that have sprung from a common origin, and hence are rightly treated as species.

In endeavouring to account for the numerous forms, Wettstein suggests three chief causes of the origin of new species, viz. hybridisation, change of climatic conditions in a region, and interruption of the period of growth of individuals through external causes. Of these perhaps the most important is hybridisation. Wettstein states that he has proved by experiment that the pollen of *Euphrasia*-hybrids usually shows no great loss of fertility, and that over half of the seed produced in such hybrids is capable of germination. He describes a number of wild hybrids, and cites *E. Portæ*, *E. stiriaca*, *E. pulchella*, and *E. drosocalyx* as species of hybrid origin. Chabert is opposed to this view, and considers that the variation of Eyebrights is often attributed to hybridity without sufficient reason. Jørgensen discusses the question in great detail, and demonstrates how a number of tolerably constant forms, by crossing with others and subsequently splitting up according to Mendelian laws, may have given rise to an apparently infinite series of forms at present morphologically indistinguishable. He considers that many of the intermediate forms in Norway are of hybrid origin, and incidentally points out, as an observed fact, that crosses between two large-flowered species or between a large-and a small-flowered species are commoner than those between two small-flowered species. As hybridity would generally be effected by insects, which would be more attracted by the larger flowers, this is what might naturally be expected.

In Britain the number of forms intermediate between those recognized as species is considerable. This is apparent in the field as well as in the material contained in British herbaria. A comparison of British and Continental exsiccata indeed suggests that intermediate forms are more than usually prevalent here, but this may possibly be due to the way in which the material has been collected. As Chabert remarks, botanists with some knowledge of a polymorphic genus often tend to gather only those forms that seem distinct.

My own experience of Eyebrights in the field, which is almost confined to Great Britain and Switzerland, is that different forms of these eminently gregarious plants do not usually grow in company, and that, when they do, they do not seem to cross freely. I have never met with two distinct species together, accompanied by numerous intermediates obviously of hybrid origin between them. I have never systematically searched for *Euphrasia*-hybrids, but on Wimbledon Common, in a spot where a glandular and an eglandular form formerly grew in mixture, I once found one or two intermediate and only partially fruiting plants that I believe were direct hybrids. From general observation I should have thought that hybridisation is not common in the genus. But if crossing does not frequently take place, yet if the progeny is largely fertile, it may give rise in time to many more or less distinct intermediate forms, some of which may eventually become separated from the original parent species. This seems to have happened in Norway, and it may account for some conditions obtaining in Britain. On Box Hill, Surrey, where *E. nemorosa* and another eglandular species are both abundant but rarely grow actually in mixture, colonies of various intermediates may be found on different parts of the hill which approach sometimes one species, sometimes the other. These appear to be the result of former crossing. In Eastern Scotland, where *E. brevipila* is widely spread and *E. curta* also occurs, intermediates partaking in various degree the characters of the two species and closely resembling Scandinavian forms regarded as hybrids, may be met with away from the parent species. These, too, may have arisen from hybridity. In North Wales, where *E. nemorosa* is perhaps the commonest form, but where typical *E. curta* also grows locally, there occurs in separate habitats an intermediate form that possesses the characters of the two species and may well have similarly originated. And other similar cases can be cited. Hybridisation may thus be one important cause of the intermediate forms that exist, some of which have become so fixed and distinct in definite habitats that they have been treated as species. A plant regarded by Wettstein as a species that bears strong marks of the hybrid origin attributed to it (*E. alpina* × *minima*) is the beautiful *E. Christii* Favrat.

Wettstein illustrates his second factor in species-building by describing how, through climatic changes, *E. stricta* and *E. pumila* Kerner have been gradually differentiated from *E. tatarica*. That changes of environment may have affected these plants to such an extent that in time they have differed so greatly as to be regarded as specifically distinct is highly probable, but to trace the steps whereby this has been brought about is not easy without resorting to undue speculation.

The chief result of Wettstein's third factor seems to be seasonal-dimorphism, which is clearly seeen in some cases and has already been alluded to under Morphology. Both Chabert and Jørgensen support Wettstein's views respecting this phenomenon, and the former extends the list of dimorphic pairs by the addition of early-summer forms of *E. hirtella*, *E. nemorosa*, and doubtfully *E. salisburgensis*. While the seasonal relationship between *E. Rostkoviana* and *E. montana*, and that between *E. brevipila* and *E. tenuis* Brenner may not be disputed, the connection between the remaining alleged pairs of species is not always evident, and the linking of *E. suecica* with *E. stricta*, and of *E. Bicknellii* Wettst. with *E. tatarica* appears unnatural, for in both these cases the form of the capsules, which would not be expected to be materially affected by this dimorphism, is markedly different.

GROUPING OF SPECIES.

In considering the relationships of the species of *Euphrasia*, the first essential is the determination of the primary groups, and the three subdivisions of the *Semicalcaratæ* defined by Wettstein at once invite criticism, for the *Angustifoliæ* contain species with elongating and non-elongating corolla-tube, and should logically be divided to correspond with the *Parvifloræ* and *Grandifloræ*, which are separated solely by this particular character. This is virtually done in Jørgensen's arrangement, for though he has no large-flowered *Angustifoliæ* in Norway, he brings Wettstein's *Parvifloræ* and *Grandifloræ* together under one series, *Ciliatæ*, which is contrasted with *Angustifoliæ* Wettstein. These plants will therefore be treated as belonging to two groups, *Ciliatæ* Jørgensen and *Angustifoliæ* Wettst.

The next question to arise is the division of the *Ciliatæ* into *Parvifloræ* and *Grandifloræ*, the species of which are treated by Wettstein as of different origin and affinities. The separation of the *Grandifloræ* as a distinct group, on the criterion of a single feature, the elongating corolla-tube, may be convenient for classification, but it may be doubted whether, in such a genus as *Euphrasia*, it affords a true indication of the real affinities. The elongating corolla-tube, which, though much misunderstood by British botanists, is certainly a distinctive feature as defined by Wettstein, and usual, if not absolutely constant, in the species which it affects, is a character which curiously recalls the dimorphic corollas of certain *Labiatæ*; and indeed the variations of the form of the corolla in *Euphrasia*, Subsect. *Semicalcaratæ*, as a whole, are very similar to those found in the single Labiate species *Nepeta Glechoma.* Species with an elongating corolla-tube occur in both subdivisions of the *Semicalcaratæ*, and those in the *Ciliatæ* where it occurs, e. g. *E. Rostkoviana* and *E. alpina*, do not all closely resemble each other in other respects. This leads one to surmise that the corolla-character may be the result of a mutation which might possibly arise in any species of the group, and that in reality it is not of primary taxonomic importance. Of the twelve species placed by Wettstein in his *Grandifloræ*, none has a really wide geographical distribution, and some of them are relatively local. The most widely spread species is probably the glandular *E. Rostkoviana*, which is abundant and typical in Germany, Austria, and Switzerland, but becomes scarcer and unstable in France, Britain, Italy, and Eastern Europe. Five of the remaining species of *Grandifloræ* are glandular plants, and *E. versicolor* Kerner, albeit eglandular, is perhaps of the same affinity. Now it is notable that one of the most widely spread species of the genus is *E. hirtella*, which resembles *E. Rostkoviana* and its allies in its peculiar glandular hair-clothing and in the form of its capsules. *E. hirtella* occurs at intervals from Spain to Manchuria, in more numerous localities than were known when Wettstein's Monograph was written, and in several different forms. Some of these forms in Eastern Europe are connected by intermediates with *E. Rostkoviana*, and in Spain, France, and Britain other intermediate forms are found. *E. hirtella* also grows in the great mountain ranges of Central Asia in the neighbourhood of Wettstein's species of the *Grandifloræ*, *E. Schlagintweitii*, *E. himalayica*, and *E. paucifolia*; and the best known of these, *E. Schlagintweitii*, is variable in the size of its flowers. It may be judged from its very wide distribution that *E. hirtella* is an ancient species, and the fact that the large-flowered forms with similar glandular clothing occur within its general area leads to the belief that it may be the common origin of all of them. If the glandular species of the *Grandifloræ* have arisen in this way from *E. hirtella*, it may be concluded that the few remaining members of the group have similarly sprung from other species with a non-elongating corolla, although their derivation may be no longer obvious. It is therefore proposed not to regard the *Grandifloræ* as a distinct and separate group, and to treat all the species with long-glandular foliage, whether with elongating corolla-tube or not, as allies of *E. hirtella.* These plants will then form one subdivision, *Hirtellæ*, of the *Ciliatæ.*

Of the *Parvifloræ* of Wettstein, most of the larger-flowered species are associated by the monographer with *E. pectinata.* This species, with *E. tatarica* (and they are closely allied and not always easily separable), has a geographical range extending from Spain to Manchuria, not unlike that of *E. hirtella*; and it may apparently be regarded as another ancient species, from which *E. stricta*, *E. pumila*, and *E. Maximowiczii* Wettst. have become differentiated. Wettstein assigns the same origin to *E. borealis*, but this view was probably taken in the absence of adequate material, and Townsend's opinion that *E. borealis* is closely connected with *E. brevipila* seems clearly more correct. Among the species of the *Parviflorœ* with really small flowers the most widely spread is *E. latifolia*, which grows in northern regions at least from Labrador and Baffin Land to Greenland, Scandinavia, and Siberia beyond the river Yenisei. This is considered by Wettstein to be another ancestral species, and with it the other slightly branched boreal species, *E. scotica*, *E. foulaensis*, *E. disjuncta* Fern. & Wieg., and *E. mollis* Ledeb. form a further homogeneous group, to which *E. minima*, *E. Willkommii* Wettst., *E. liburnica* Wettst., and *E. Oakesii* Wettst., of a different geographical area, and perhaps also *E. gracilis*, may be added. All of these plants, except *E gracilis*, are essentially of the early-summer type of growth, with inconspicuous flowers and usually eglandular foliage. Wettstein associates with these forms the much-branched species of late-summer type, *E. nemorosa*, *E. curta*, *E. americana* Wettst., and *E. multifolia* Wettst. The two first-named plants show almost equal affinity with *E. stricta*, and are perhaps of mixed origin ; and they seem best placed as a separate group with *E. americana*, a doubtful species of similar features, which may have been introduced from Europe in comparatively recent times. *E. multifolia* in its foliage recalls Wettstein's Japanese species of the *Angustifoliœ* and the lately described *E. Matsumuræ* Nadai, and it may be of hybrid parentage.

The *Angustifoliœ* of Wettstein form a much smaller group, which includes species with very large (*E. tricuspidata*) and very small flowers (*E. salisburgensis*), and with elongating and non-elongating corolla-tube. The significance of the latter character must be held of the same value here as with the *Ciliatœ*. Ten species only of this group are described in the Monograph, of which eight are European and two Japanese. Among the European species, one only, *E. salisburgensis*, has a wide distribution, and this does not extend beyond Europe. The other European species are local, and with *E. salisburgensis* form a fairly-defined series connected with the *Ciliatœ* chiefly through *E. alpina*. The Japanese species show fundamental differences, and apparently constitute another well-marked group with other forms that have been more recently described.

THE BRITISH FORMS.

The arrangement of the British Eyebrights as given in recent text-books and plant-lists takes its origin from Townsend's Monograph (1897) and requires considerable revision. Townsend appears to have copied verbatim, without any independent corroboration, Wettstein's group definitions and his Latin diagnoses of the species which were shown as growing in Britain. This was particularly unfortunate in the case of the *Grandiflorœ*, two species of which were given for Britain by Wettstein, viz. *E. Rostkoviana* and *E. Kerneri*. The former of these was recorded for four British stations, and in Townsend's work of 1897 several new ones were added which produce a different form that does not possess an elongating corolla-tube. This form is the prevalent one in South Britain, and as it has been regarded here as typical *E. Rostkoviana* and obviously has a corolla whose tube does not appreciably lengthen, Wettstein's definition of this organ has been questioned by British botanists ignorant of the Continental type, and the elongating character has been held to be altogether unreliable. A similar mistake has happened with *E. Kerneri*. Wettstein inserted "England" as a habitat for this plant on the authority of two examples from Chelsham, in Surrey, and the identification was accepted by Townsend, who recorded additional stations. This was a misidentification, and it has increased the confusion among British botanists concerning the elongating corolla-tube, for the British plant referred to *E. Kerneri* shows this feature only in a modified degree, while in the true plant it is most conspicuous.

Another species reported as British by Wettstein is *E. stricta*, for which a solitary station, "Surrey Downs—Hb. Townsend," is given in the Monograph. Townsend states (Journ. Bot xxxv, 398) that this record is erroneous and that he cannot ascertain that *E. stricta* is a native of Britain, but later (*l.c.* 475) he cites five British stations for this plant, two determined by Wettstein and three by himself. The specimens in these cases are weak examples of the British plant referred to *E. Kerneri*, which, when dried, is sometimes not readily separable from poor material of *E. stricta*. The question of the occurrence of *E. stricta* in Britain is dealt with at length in Journ. Bot. lx. 3 *sq.* (1922), where it is shown to be unknown with us. It may be added that this common Central European species is well portrayed as *E. officinalis* in Hayne's 'Arzneigewächse,' ix, tab. 8 (1825), where it contrasts with *E. Rostkoviana* in an adjacent plate. The Irish material referred to *E. stricta* has also been found to belong to other species.

Townsend added to the British list another species, *E. latifolia*, which was not treated as British in Wettstein's Monograph. This was first based on two specimens gathered by Marshall near Melvich, Sutherland, on whose label Wettstein wrote "? *E. latifolia* Pursh," and subsequently on further material collected by Marshall in the same district and apparently confirmed by Wettstein (Journ. Bot. xxxv, 421). This plant has been gathered on various subsequent occasions in the neighbourhood of Melvich, where I saw it in some abundance in 1927, and it is now quite well represented in British herbaria. To my eyes it shows very slight resemblance to *E. latifolia*, being mostly a coarse, branched plant of late-summer habit much nearer to *E. curta*; and I cannot understand how it could have been so identified by Wettstein. In Townsend's herbarium there are Melvich specimens of this plant collected by Marshall and named *E. latifolia*, and others, exactly similar and also from Melvich, collected by Townsend himself and labelled *E. curta*. As this is a well-marked and constant form, which presents differences also from *E. curta*, it has been treated as a distinct species and named after the late Rev. E. S. Marshall, through whom it was brought to notice.

In several of the gatherings of this plant there is an admixture of younger examples of another form with nearly round leaves, which seems to flower rather later and generally shows no fruit. It is found to occur also in Shetland, and is fortunately represented by a fruiting specimen in Beeby's herbarium, from which its characters can be judged. This plant seems to merit distinction as a second new species.

The identification of these Melvich plants with *E. latifolia* has given rise to further confusion, for the true plant of Pursh, as interpreted by Wettstein, has also been collected by Marshall and others on the Scottish mountains, and has been referred to *E. foulaensis*, which was stated by Wettstein in his Monograph to be a very close ally. By comparing the Scottish exsiccata labelled *E. foulaensis* in Herb. Mus. Brit. with the fine series of Scandinavian *E. latifolia* there, it can readily be seen that the plants of the higher Scottish mountains are distinct from *E. foulaensis* of the northern coast and islands, and belong to *E. latifolia*. The name *E. latifolia*, therefore, still remains in the British list, but stands for a fresh plant hitherto confused with *E. foulaensis*.

A species introduced in the British Flora by Townsend in his Monograph with some doubt is *E. campestris* Jord. The plant thus identified was collected near Buxton, in Derbyshire, and was first determined as *E. brevipila* by Wettstein, who afterwards declared it to be a doubtful form. *E. campestris*, which is a local French plant extending from Lyons to Geneva and flowering very late in the summer, has a corolla of markedly *Grandiflora* type and is clearly different from the British plant, which produces flowers of moderate size only and is probably a hybrid between a glandular form and one of the *nemorosa*-group. Bucknall's variety *neglecta* (Brit. Euphr. p. 19) differs but little from Townsend's Derbyshire plant, and is probably also of hybrid origin.

The most important addition to the British *Euphrasia*-list since the time of Townsend is *E. minima* Jacq.,which was elaborately published as an Exmoor plant by Hiern in Journ. Bot. xlvii, 165 *sq.* (1909). This identification was contested in my paper in Journ. Bot. lvii, 169 *sq.* (1919), and the Exmoor plant described as a new species, *E. confusa*, an ally of *E. nemorosa*. Other quite different British plants, largely depauperate forms of *E. gracilis*, have more recently been referred to *E. minima*, and it may therefore be well to recapitulate the salient features of this well-marked though polymorphic species, which was succinctly diagnosed by Persoon in 1807 "caule simplicissimo . . . foliis dentibus obtusis, floribus subcapitatis lutescentibus" (Syn. Pl. ii, 149). *E. minima* is distinctly an early-summer form, which often begins to flower at the second pair of leaves and in most forms not later than the fourth pair. Its stem is slender and erect, and in many localities it is uniformly unbranched ; in others the majority of the individuals throw a few suberect, slender branches from the flowerless nodes towards the base of the stem. Very occasionally more robust forms are found, which begin to flower at a higher node and may be more branched. The internodes are relatively long, except in condensed forms, and the leaves are not numerous ; these latter are rather large and broad, with a broad and rounded apex except the uppermost. The hair-clothing of the foliage is very variable, hirsute, pubescent, or subglabrous, but not glandular. The very small corolla, with short lower lip, is typically bright yellow, often with the upper lip violet, but it is occasionally whitish (possibly through hybridity), and in the Maritime Alps there is a purple-flowered form which also presents other points of difference from the type. There is further the variety *pallida* Gremli, which Chabert treats as a separate "micromorphe." The most striking features of the species are its diminutive stature and its tiny, bright yellow flowers. *E. minima* is very common in the Swiss Alps, where it ascends to over 9000′. It loves sunny, well-drained slopes, often grows on old moraines, and rarely, if ever, inhabits wet ground. The form inhabiting Scandinavia is never yellow-flowered, according to Jørgensen, and appears to agree best with var. *pallida*. It grows, at least sometimes, on wet moorlands, which are prevalent in Scandinavia as in Scotland, but are rarely met with among the Alps of Central Europe ; and from this difference of habitat, combined with the absence of the typical yellow-flowered form, I think it may be doubted whether the Scandinavian plant is genetically related to *E. minima*, although it may not be possible to distinguish it morphologically except by the corolla. I have seen no British material resembling var. *pallida*, nor any nearer to *E. minima* than are *E. scotica*, *E. latifolia*, and *E. foulaensis*.

Three further species of questionable occurrence are added to the British list in Bucknall's 'British Euphrasiæ.' The first of these, *E. cærulea*, is inserted provisionally owing to the resemblance of a form collected in Orkney to this blue-flowered species of Central Europe. The Eyebrights of Northern Scotland, Orkney, and Shetland are varied and difficult to understand without an acquaintance with the living plants in their natural habitats, but this Orkney plant (Johnston, Hoy, 1912) shows the strict stem and numerous narrow leaves of *E. gracilis*, and appears to be a hybrid between that species and probably *E. borealis*. The second species introduced by Bucknall is *E. suecica*, based on specimens from Grassington, Yorks, and Tain in Scotland. This again does not seem a likely species for Britain. The Grassington plant I have not been able to see, but that from Tain is a white-flowered form that is almost certainly much drawn up eglandular *E. brevipila*. Bucknall's third new species for Britain is *E. fennica*, which he shows as occurring on Exmoor and in Galway, Ireland. The Exmoor examples that I have seen, and also the Galway material in Herb. Bucknall, do not appear to me to belong to *E. fennica*. Some peculiar but inadequate specimens received last summer from the west of Ireland do, however, somewhat resemble it. *E. fennica* is a glandular form from Eastern Europe connected with *E. hirtella* and *E. Rostkoviana*, combining the strict habit of the former with the bright green foliage of the latter, and producing numerous cauline leaves and branches placed high on the stem. Bucknall also adds two varieties to the British *E. minima*. The first of these (var. *nana* Rouy) is represented in his collection (Elmhow, Westmoreland) by what seems to be diminutive *E. curta* ; of the second (var. *arbuscula* Bucknall) the two types

(Patterdale, 1915 and 1916) are *E. confusa* f. *albida*, but Welsh material collected later and similarly named belongs to a different form allied to *E. curta*, to be described later.

In addition to the species that have been already mentioned as British, there are a number of more or less fixed local forms whose position is in doubt. Three such plants have been described as species in the Reports of the Botanical Exchange Club (British Isles). The descriptions, however, though lengthy, are invalidated by the absence of Latin diagnoses, which, if written after the method adopted by Wettstein, would have enabled the new plants to be compared with the established species. Moreover, no definite exsiccata are cited, and except in the case of *E. atroviolacea* Druce & Lumb, the specimens distributed are not homogeneous. There are other intermediate forms, such as some of those that have been named *E. curta*, var. *glabrescens*, that have the appearance of hybrid origin, though they do not grow in company with their presumed parents. These plants will generally be treated as hybrids, as has been done by Jørgensen with certain Scandinavian forms. Some other forms that appear permanently distinct in more or less minor features will be regarded as varieties or forms, but sometimes so little is known of seemingly peculiar plants that it is thought undesirable to create additional names for them at present. Throughout the whole group an endeavour has been made to trace and to define accurately the specific types, which hitherto has not been attempted by British botanists.

NOTABILIA.

In the following account the descriptions have been drawn up from normal plants, and may not cover damaged, monstrous, or depauperate individuals such as may often be found. Italicised leading contrasting characters are shown throughout. All known useful figures are quoted ; some plates, though of recent date, are practically worthless, while certain early ones, though not entirely accurate, are eminently characteristic. The exsiccata cited (including those in the distribution lists) have all been examined, and are generally to be found in the herbaria of the British Museum (South Kensington) or at Kew, unless stated otherwise. The Townsend and Beeby herbaria are now at the South London Botanical Institute, and the Bucknall collection is at Bristol University. The sign ! indicates that I have collected the plant *in situ*.

The pairs of leaves referred to exclude the cotyledons, and the number of teeth given for the leaves, cauline or floral, is that on each side of the apex. The length of the corolla is taken from the finest flowers, and is measured from the base of the tube to the apex of the upper lip, as seen in dried specimens. The characters and size of the capsule are taken from that organ in its mature state.

The time of flowering, which is chiefly July and August for most of the species, has not been given unless it is exceptionally early or late.

It should be noted that, in collecting Eyebrights, nibbled plants, in which the main stem has been bitten off, should be avoided, if possible. A specimen should consist of not less than six representative individual plants. It is well to dry material separately in a small press, for Euphrasias readily become discoloured when put into a large press with other plants.

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EUPHRASIA.

Euphrasia L. Sp. Pl. 604 (1753), ex parte ; Bentham in DC. Prodromus, x, 552 (1846) ; Wettstein in Engler & Prantl, Pflanzenfam. iv. Teil, Abt. 3 *b* S. 100 (1893) ; Mon. Gattung *Euphrasia*, 9 (1896) ; *Euphrasia* Sect. *Euphrasium* Duby, Bot. Gall. i, 354 (1830).

Subgenus Eu-Euphrasia Jørgensen, Euphrasia-Arten Norwegens, 70 (1919) ; Wettstein in Engler & Prantl, Pflanzenfam. *l. c.* and Mon. 68 (as Section).

Leaves simple, with 1–10 acute or obtuse teeth on each side. Anthers pilose, very rarely glabrous.

Plants of Europe, Azores, Extra-tropical Asia, North America, Australia, and New Zealand.

Section Semicalcaratæ Bentham, *l.c.* ; Wettstein, Mon. 68 (as Subsection).

Annual plants ; anthers mucronate, with one loculus of each of the two short posterior stamens more strongly spurred than the other.

Plants of the Northern Hemisphere.

Conspectus of Species.

Subsection I. CILIATÆ.

Floral leaves generally more than half as broad as long, acutely or more rarely bluntly serrate with ± contiguous teeth. Capsule ciliate with long, straight marginal hairs.

Series I. Latifoliæ.

Plants of slender or early-summer habit, and but slightly branched. Foliage in British forms nearly glabrous (occasionally sparingly hirsute), and eglandular except in *E. latifolia*. Corolla small.

1. *E. micrantha.*	Of slender and strict habit, branched often high up the stem, with numerous small and narrow leaves. Lower lip of variously coloured corolla longer than the upper. Capsule narrow, usually exceeding its subtending leaf.
2. *E. scotica.*	Less erect, with fewer and lower branches, and less numerous, often larger leaves. Lower lip of typically whitish corolla subequalling the upper. Capsule medium, usually not exceeding its subtending leaf.
3. *E. latifolia.*	Suberect and lax in habit, with very few branches and distant, obtuse leaves below. Lower lip of whitish corolla longer than the upper. Capsule large, broad, and deeply emarginate.
4. *E. foulaensis.*	Erect, shorter, and less slender, usually with few branches, and broad, obtuse leaves. Lower lip of violet (or rarely whitish) corolla not greatly exceeding the upper lip. Capsule large, broad, and emarginate.

Series II. NEMOROSÆ.

Generally more robust plants, of late-summer habit and much branched (except *E. rotundifolia* and some forms of *E. occidentalis*). Foliage subglabrous, hirsute, or more rarely shortly glandular. Corolla generally small, except in *E. Pseudo-Kerneri*, with lower lip exceeding the upper.

5. *E. rotundifolia.*	Erect, with short branches and rotundate, crenate, strongly hirsute leaves. Corolla small, white. Capsule large, broad, exceeding the short calyx-teeth.
6. *E. Marshallii.*	Erect, with erect-spreading (often long) branches and large, broad, obtuse, strongly hirsute leaves. Corolla of moderate size, white. Capsule large, broad, equalling or exceeding calyx-teeth.
7. *E. curta.*	Erect, with basal, ascending branches, and small, acute, hirsute leaves. Corolla small, white. Capsule rather small and narrow, subequalling fine calyx-teeth.
8. *E. cambrica.*	Very dwarf, ascending, branched, with obtuse, sparingly hirsute leaves. Corolla very small, whitish. Capsule relatively large and broad, exceeding calyx-teeth.
9. *E. occidentalis.*	Erect, robust, often much branched from below, with mostly obtuse leaves, which are normally puberulous and short-glandular. Corolla small, white. Capsule rather large, normally exceeding calyx-teeth.
10. *E. nemorosa.*	Erect and often tall, with spreading branches and rather small, acute, subglabrous leaves. Corolla normally small, white. Capsule medium or rather small, rarely exceeding calyx-teeth.
11. *E. confusa.*	Ascending, with spreading, slender, flexuous branches, and small, subacute, normally subglabrous leaves. Corolla small, yellow or whitish (purple in var. *atroviolacea*). Capsule rather small but broad, often exceeding calyx-teeth.
12. *E. Pseudo-Kerneri.*	Erect, with spreading branches, and small, acute, subglabrous leaves. Corolla large, usually white. Capsule rather small, usually not exceeding calyx-teeth.

Series III. BREVIPILÆ.

Robust and often tall plants, normally of early-summer habit. Foliage subglabrous, puberulent or shortly (longer in *E. brevipila* vars. *notata* and *reayensis*) glandular. Corolla usually large, with broad lower lip much exceeding the upper.

13. *E. borealis.*	Erect and often lax below, with rather few, erect-spreading branches, and large, broad, subglabrous leaves. Corolla normally white. Capsule large, exceeding calyx-teeth.
14. *E. brevipila.*	Erect and often lax, with erect-spreading branches, and ± large, normally short-glandular leaves. Corolla typically lilac. Capsule large, often exceeding calyx-teeth.

Series IV. HIRTELLÆ.

Plants of early- or late-summer habit, little or much branched. Foliage clothed with long, waved, glandular hairs. Corolla small to very large, with lower lip porrect, exceeding (sometimes greatly) the upper. Capsule broad, ± emarginate.

15. *E. Rostkoviana.*	Of late-summer habit, suberect, with slender, flexuous branches, and numerous, subacute leaves. Corolla white, typically very large, with elongating tube.

16 *E. montana.*	Of early-summer habit, erect and lax, with few, slender branches, and few, obtuse leaves. Corolla white, very large, with elongating tube.
17. *E. rivularis.*	Of early-summer habit, dwarf, erect, slender, very slightly branched, with small, obtuse leaves. Corolla lilac-tinted, large, with non-elongating tube.
18. *E. anglica.*	Of late-summer habit, ascending, with long, flexuous branches, and numerous, rather broad leaves. Corolla whitish, large, with non-elongating tube.
19. *E. hirtella.*	Erect and typically robust, almost unbranched, with numerous, broad leaves. Corolla white, rather small, with non-elongating tube.

Subsection II. ANGUSTIFOLIÆ.

Floral leaves generally less than half as broad as long (sometimes very much narrower), with more distant, narrow, and acute teeth. Capsule glabrous, or ciliate with weak marginal hairs.

20. *E. salisburgensis.*	Erect, generally much branched with erect-spreading branches. Corolla small. Capsule normally glabrous.

SUBSECTION I. CILIATÆ Jørgensen, Euphr. Norweg. 61 (1919).

SERIES I. LATIFOLIÆ.

Plantæ graciles vel habitu speciebus æstivalibus simili, et leviter ramosæ. Folia in formis britannicis fere glabra vel parce hirsuta, eglandulosa nisi in *E. latifolia*. Corolla parva.

1. EUPHRASIA MICRANTHA Reichb. Fl. Germ. Excurs. 358 (1831–32); Jørgensen *l.c.* 142 (1919), non *E. micrantha* Brenner (1879). *E. officinalis* var. *gracilis* Fries, Fl. Halland, 104 (1819). *E. gracilis* Fr. ex Wettst. Mon. 143 (1896); Townsend in Journ. Bot. xxxv, 423 (1897); Chabert in Bull. Herb. Boiss. tome ii, 2^{me} série, 275 (1902). [Pl. **26**, figs. *a*, *b*.]

Icones. Reichb. Fl. Germ. and Helv. xx, tab. mdccxxxii, figs. 4 & 7; Wettst. *l. c.* tab. viii, ff. 2 (as *E. gracilis*) & 3; Journ. Bot. tab. 376 (as *E. gracilis*); Jørgensen, *l.c.* tab. xiii, ff. *a–m*.

Exsicc. Reichb. Exs. No. 242; Fries, Hb. Norm. ii, 30, as *E. gracilis*, a. *albiflora*, b. *amethystina*; Kerner, Fl. Exs. Austro-Hungarica, No. 636; Dörfler, Hb. Norm. 3360, as *E. gracilis*, and 3361, as *E. gracilis* v. *primaria*; Marshall, No. 2063, as *E. gracilis*.

Stem slender, erect, and *strict*, 5–30 cm. high, purplish and clothed with fine, crisped, whitish hairs, *with numerous small leaves* not readily caducous, and generally long lower and rather short upper internodes; usually not flowering till about the 7th pair of leaves above the cotyledons; sometimes simple, but more often *producing* from the upper flowerless axils (and so *about the middle of the stem*) ± numerous, *slender, erect branches*, with very occasionally secondary branches in very luxuriant plants. *Leaves narrow*, dark green or purple-tinted, ± erect, the largest rarely more than 8 mm. long (and usually much less); lower cauline oblong, obtuse with 1–2 blunt teeth on each side, and cuneate below; upper cauline oval, ± obtuse, with 2–4 more acute teeth; floral ovate, acute, with about 4 acute or acuminate teeth; all *glabrous* or with minute bristles on the margins and nerves of the underside. Calyx glabrous or with minute bristles on the teeth and nerves, with short, finely acuminate teeth and frequently purplish-tinted nerves, scarcely accrescent in fruit. *Corolla small,* dorsally 4–7 mm. long, *very variable in colour,* typically white, but oftener lilac, violet (var. *primaria* Fr.), or purple, with a deep yellow spot on the lower lip and commonly strong purple lines on both lips; upper lip with very small, subentire or retuse, usually porrect lobes; *lower lip longer than the upper,* deflexed, with three narrow, emarginate segments, the median longest. *Capsule* 4–6 mm. long, ± *narrowly oblong, truncate* or more rarely retuse, glabrous except the ciliate margins, usually *exceeding* the calyx-teeth and *its subtending leaf.*

form. nov. *simplex.* [Pl. 26, fig. *c.*]

Exsicc. Fl. Polonica Exsicc. No 555, ut *E. gracilis*; Pearsall, No. 74, ut *E. minima* (typus).

Gracillima, haud ramosa, sæpe foliis numerosis plus minusve elongata. Very slender, unbranched, often elongate with many cauline leaves.

Reichenbach's trivial has been adopted for this plant, in place of the more familiar *E. gracilis*, as being the earliest valid specific name. There seems to be no doubt but that the same plant was intended by Reichenbach and by Fries.

This species is one of the most uniform and most easily distinguished in the whole Subsection. It varies most in the colour of its flowers, which ranges from white to deep blue or almost crimson. The type, both of Reichenbach and of Fries, is the white-flowered form, which is less common in Britain. Fries's variety *primaria* (Nov. Fl. Suec. Mantissa, ii, 63) was described as "herba colorata, floribus saturate amethystinis," and scarcely seems to merit distinction. Jørgensen describes two varieties, *transiens* and *subfoulaensis*, from Norway, which show some approach towards *E. foulaensis* and *E. scotica* and have a considerable area of distribution. These varieties have not been recognized in this country, albeit individual plants closely resembling them may be found among the multiplicity of intermediate forms in the North of Scotland. A remarkable, intricately branched form with bright blue flowers, received from Ballyvaughan, Co. Clare, Ireland, in 1928, may (if not a hybrid) prove to be worthy of a varietal name.

E. micrantha is a plant of moors, heaths, and commons, on light soils not too wet. It is found in such situations throughout Great Britain from Cornwall and Surrey to Shetland, and it also occurs in Ireland and in the Channel Islands. The unbranched form *simplex* usually grows in damp or boggy localities, and has been mistaken for *E. scotica* and *E. minima*, from both of which it may be distinguished by its different corolla.

The British vice-counties from which specimens have been seen are :—

1. W. Cornwall : Goonhavern (Rilstone). Quintrell (Hume). 2. E. Cornwall : Kittow's Moor (Little). 3. S. Devon: Yannadon (Hume). Dousland—f. *simplex* (Hume). 4. N. Devon : Badgworthy—f. *simplex* (Salmon). 5. S. Somerset : E. Anstey (Marshall). 9. Dorset : Wych (Salmon). 14. E. Sussex : Horsted Keynes (Whitwell). 17. Surrey : Witley (Crespigny). 28. W. Norfolk : S. Pickenham (Robinson). 34. W. Glo'ster : Drybrook Meend (Knight). 38. Warwick : Balsall (Bromwich). 42. Brecon : Craig Gleisiad (Barton). 45. Pembroke : Precelly ! 46. Cardigan : Plynlimmon (Ley). 48. Merioneth : Tan-y-Bwlch ! 49. Carnarvon : Beddgelert ! 51. Flint : Rhyl (Parsons). 52. Anglesea : Holyhead ! 58. Cheshire : Thursaston (H. S. Fisher). 60. W. Lancs : Hindburndale (Wilson). 62. N.E. Yorks : Helmsley (Baker). 65. N.W.Yorks : Cotherstone (Thompson). 69. N. Lancs : Bigland—f. *simplex* (Pearsall). 70. Cumberland : Borrowdale ! 71. I. Man : Carnanes (Wheldon). 72. Dumfries : Correifron—f. *simplex* (Marshall). 74. Wigton : Portpatrick (Bailey). 87. W. Perth : Ben Venue (Mott). 88. Mid Perth : Ben Lawers ! 89. E. Perth : Ben Vrackie ! 91. Kincardine : Strachan (Sim). 92. S. Aberdeen : Braemar ! 95. Elgin : Dava (Marshall). 96. Easterness : Aviemore (Marshall). 97. Westerness : Fort William ! 98. Argyll : Appin (Bailey). 100. Clyde Is : Arran (Marshall). 103. Mid Ebudes : Tiree (Salmon). 105. W. Ross : Loch Maree (Bailey). 106. E. Ross : Strathpeffer (Bailey). 107. E. Sutherland : Lairg (Salmon). 108. W. Sutherland : Melvich ! 109. Caithness : Thurso (Riddelsdell). 111. Orkney : S. Ronaldshay (Johnston). 112. Shetland : (Burdon).

General Distribution. North-West Europe, including Scandinavia, Germany, Bohemia, and a large part of France.*

2. EUPHRASIA SCOTICA Wettstein, *l. c.* 170 (1896) ; Townsend, *l. c.* 425 (1897) ; Jørgensen, *l.c.* 131 (1919). *E. paludosa* Towns. in Journ. Bot. xxix, 161 (1891), non R. Br. [Pl. 26, figs. *d*, *e*.]

Icones. Wettst. *l. c.* tab. viii, f. 8 (as *E. paludosa*); Journ. Bot. tab. 376 ; Jørgensen, *l. c.* tab. x, f. *t*, tab. xii, ff. *a–b*.

Exsicc. Schultz, Hb. Norm. 2873, as *E. paludosa* ; Marshall, Nos. 1640 and 2062 ; Pugsley, No. 404.

Stem slender, erect and ± flexuous, 5–25 cm. high, green or tinged with red, and clothed with crisped, deflexed, whitish hairs, *with distant leaves* not readily caducous, and long internodes, at least below ; usually flowering from the 5th or 6th pair of leaves ; simple or emitting a *few slender, suberect branches towards the base of the stem. Leaves narrow*, light green, or occasionally purplish, rarely spreading, the largest not exceeding 8 mm. in length ; cauline oblong, obtuse, cuneate below, with 1–3 obtuse teeth on each side ; floral elliptic or ovate, with 4–5 obtuse, acute or occasionally acuminate and spreading teeth ; all *glabrous* or with a few fine bristles on the margins. Calyx glabrous, or setulose on the teeth and nerves, with finely acuminate teeth, scarcely accrescent in fruit. *Corolla small*, dorsally 4–6 mm. long, *whitish*, with a yellow spot on the lower lip and ± marked dark lines on both lips ; upper lip with very small, subentire, porrect lobes ; *lower lip* with three subequal, emarginate lobes (the median short and narrow) *scarcely exceeding the upper. Capsule* 4–6 mm. long, ± *narrowly oblong, retuse* or truncate, nearly glabrous except the ciliate margin, *usually not exceeding* the calyx-teeth or *its subtending leaf.*

form. nov. *estriata.* [Pl. 26, fig. *f*.]

Exsicc. Pugsley, No. 428.

Habitu robustiore, corollâ fauce flavo-maculatâ sine striis purpureis lacteâ a typo differt.

Robuster in habit than the type, with a milky-white corolla bearing a yellow spot on the lower lip, but entirely without dark lines.

β. purpurascens, var. nov. [Pl. 26, figs. *g*, *h*.]

Exsicc. Pugsley, No. 449 (typus) ; Beeby, Nos. 1128 and 1182 ; Johnston, Nos. 1888 and 1956.

Planta vix ramosa quam typus sæpius minor foliis magis numerosis, paulo latioribus plus minusve purpureo-tinctis corollisque minimis plus minusve violaceis.

Usually smaller than the type and rarely branched, with more crowded, rather broader, purple-tinted foliage and very small, violet (at least the upper lip) corollas. This form may owe its origin to crossing with *E. foulaensis* or *E. micrantha.*

Among British species the only one with which *E. scotica* is likely to be confused is *E. micrantha.* From this plant *E. scotica* (excepting var. *purpurascens*) differs by its laxer and coarser habit, with fewer, lower branches, and fewer, larger leaves of a lighter green. It also differs in the corolla, which has a distinctly shorter, more equally lobed lower lip, and hence appears a rather smaller flower. The capsule of *E. scotica*, though variable, is on an average rather broader and more retuse, and its surface rather less glabrous.

E. minima Jacq., to which *E. scotica* was likened by Wettstein (*l. c.* 171) and by Ostenfeld (Bot. Faroes, 844 (1905–8)), may be separated by its still more basal branching, for it commonly flowers from the 4th pair of leaves and sometimes even from the 2nd pair. Its leaves are also broader and less cuneate based than those of *E. scotica*, with a wider and more obtuse terminal lobe, and they are generally much more hirsute. The characteristic yellow corolla and more elliptical capsule are further marks of *E. minima*, which is generally a plant of less lax growth and often smaller in all its parts.

The variety *purpurascens* resembles *E. micrantha* f. *simplex* and occasionally slender forms of *E. foulaensis*, but it seems separable from both by its smaller corolla with very short lower lip.

E. scotica inhabits wet and boggy moorlands, and with us is found chiefly in Scotland, where it ascends to over 3000 ft. It is also recorded by Praeger for the west of Ireland. The variety *purpurascens*, which grows in similar situations, is widely spread in Orkney and Shetland, and will probably be found in a number of Scottish vice-counties. The form *estriata* was collected on the tableland at the head of the Clova valley, Forfar, where it grew in some abundance. An unbranched, hirsute form, growing at Tongue, W. Sutherland (Marshall, No. 2398), appears to have been correctly determined as *E. scotica* × *curta*.

The known British vice-counties are :—

49. Carnarvon: Cwm Idwal (Goode), &c.! 65. N.W. Yorks: Cronkley Fell (Miss Todd). 69. N. Lancs: Dalton-in-Furness (Pearsall). 70. Cumberland: Glaramara! Ullswater! 86. Stirling: Strathblane—var. *purpurascens* (Turrill). 88. Mid Perth: Loch Tay! Loch Rannoch—var. *purpurascens*! 89. E. Perth: Ben Vrackie! 90. Forfar: Glen Dole, with f. *estriata*! 92. S. Aberdeen: Braemar (Townsend)! 96. Easterness: Kingussie (Marshall). 97. Westerness: Glen Spean (Marshall). 98. Argyll: Kingshouse (Marshall). 101. Cantire: Ardrishaig (Salmon). 104. N. Ebudes: Skye (Linton). 105. W. Ross: Poolewe (Townsend). 106. E. Ross: Aultguish (Riddelsdell). 108. W. Sutherland: Bettyhill (Marshall). 111. Orkney, with var. *purpurascens* (Johnston). 112. Shetland, with var. *purpurascens* (Beeby).

General Distribution. Faroes (Ostenfeld). Norway, as far north as Trondhjem (Jørgensen).

3. EUPHRASIA LATIFOLIA * Pursh ex Wettstein, *l.c.* 136 (1896): Jørgensen, *l. c.* 99 (1919), non L. Sp. Pl. 604, nec auct. angl. *E. arctica* Lange ap. Rostrup in Bot. Tidssk. 1, iv, 47 (1870)? *E. officinalis* var. *latifolia* Lange, Fl. Danica, vol. xviii, H. 49, p. 9 (1877); *E. foulaensis* auct. angl. ex parte. [Pl. **27**, figs. *a–e*.]

Icones. Fl. Danica, 2910, as *E. officinalis* var. *latifolia*; Wettst. *l. c.* tab. xi, ff. 11 & 12: Journ. Bot. tab. 375; Jørgensen, *l. c.* tab. viii, ff. *d–i*, tab. ix, ff. *c–e*, *l–n*, *s–v*.

Exsicc. Dorfler, Hb. Norm. 5148 and 4736 (f. *eglandulosa*); Andersson, Fl. Lapp. Exs. No. 40, in Hb. Kew, as *E. officinalis*; Marshall, Nos. 1834, 1846, 2070, 2071, 2391, 2396, and 2945, all as *E. foulaensis*; Pugsley, Nos. 457, 458, 459, 460, and 461.

Stem erect, *slender*, 5–20 cm. high, green or reddish, clothed with crisped, deflexed, whitish hairs, *with few broad*, often alternate *leaves*, not early caducous, and *very long internodes below*, and crowded, sometimes larger leaves, with very short internodes above; flowering from the 2nd to the 4th pair of leaves; simple or *with* 1–3 *slender, erect, basal branches. Leaves rather broad*, thick, light or dull green, ± spreading, the upper sometimes 15 mm. long, but usually much less; cauline oblong to broadly ovate, with large, rounded-obtuse apical lobe and 1–4 obtuse, ascending (except sometimes the lowest, which may be very small and acute) teeth on each side; lowest floral leaves similar, remainder broader and sometimes larger, ± orbicular, with 4–5 deeper and more acute (sometimes acuminate) teeth; all *subglabrous*, with minute bristles on the margins, *or with these bristles scattered also over the upper surface and ± numerous, longer hairs on the nerves below*, sometimes also with minute stalked glands. Calyx with similar clothing on the nerves and teeth only, or over the whole surface, with long, sometimes finely pointed teeth, accrescent in fruit. *Corolla small*, dorsally 5–8 mm. long, *white with lilac or pale blue upper lip*, with a yellow spot on the lower lip and dark lines best marked on the upper lip (median line of lower lip sometimes wanting); upper lip relatively narrow, with porrect or recurved, subentire or emarginate lobes; *lower lip exceeding the upper*, with emarginate lobes, the median usually rather longer and narrower than the two lateral. *Capsule* large, 5–8 mm. long, *elongate-elliptic*, usually deeply *emarginate*, ± pilose above as well as ciliate, equalling or exceeding the calyx-teeth, distinctly pedunculate.

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* The recent Congress at Cambridge having decided to reject homonyms, the name *E. latifolia* cannot be used. It is therefore proposed, as some doubt attaches to the identity of *E. arctica* Lange, to substitute a fresh name EUPHRASIA FRIGIDA.

This species, which is represented in Britain by forms closely allied to, if not identical with, the Norwegian variety *obtusata* Jørgensen, is of typical æstival habit and is related morphologically to *E. minima* Jacq. It differs chiefly in its tendency, when well grown, to produce larger floral leaves towards the apex of the stem, in its mixed hair-clothing with occasional stalked glands, in the difference of shape and colour of its corolla, and in its more deeply emarginate capsules. From *E. micrantha* and *E. scotica* its lax habit, broad leaves, and large emarginate capsules readily distinguish it.

A curious unbranched form, apparently intermediate between *E. latifolia* and *E. curta* var. *rupestris*, but with fairly large flowers, was collected by Mr. Barton in 1920 at Craig Gleisiad, Brecon (Nos. 491, 493, and 494), growing in company with a small form of *E. nemorosa* var. *collina*, and forming hybrids with it. I have myself collected this form very sparingly in Carnarvonshire.

E. latifolia has hitherto been confused by British botanists with *E. foulaensis*, as already stated, largely owing to Pursh's name having been erroneously applied to other quite different Scottish forms. It is a widely distributed plant on the Scottish mountains, where it sometimes grows in abundance, usually above 2000 ft. alt., on and about damp, alpine rocks. On Cairngorm it occurs at over 3500 ft. Specimens from Shetland in Herb. Beeby (Glusswater, No. 1174, and Hamar Voe, No. 1175) appear intermediate between *E. latifolia* and one of the following hirsute species. A hybrid with *E. brevipila* (Marshall, No. 1847) has been collected on Ben Loyal. The occurrence of this species in Teesdale is remarkable, if correct, but some doubt attaches to the identification, owing to the insufficiency of the material examined.

The account of *E. latifolia* in Pursh's 'Flora Americæ Septentrionalis,' ii, 430 (1814) is copied from that of Linnæus (Sp. Pl. 604), which refers to a totally different plant not found in America and now placed in the genus *Parentucellia*. Pursh, however, states that his plant grows in Labrador, and his name has been applied to the species here described solely because no other Eyebright is known to grow in that country. The earliest certain description of the plant as a species is that in Wettstein's Monograph, where the name is attributed to Pursh on these slender grounds. There is one other specific name that has been applied to this plant, viz.: *E. arctica* Lange, but Rostrup's diagnosis cited above clearly does not agree with *E. latifolia*, and the name is not subsequently taken up by Lange himself. It is therefore thought best to follow Jørgensen with the name *E. latifolia* (Pursh) Wettstein.

E. latifolia, which has not been seen from Ireland, is known for the following British vice-counties :—

65. N.W.Yorks: Teesdale (Rayner) ? 72. Dumfries: Moffat (W. R. Linton). 88. Mid Perth: Loch-na-Larige (Miss Todd). Cam Creag ! Ben Lawers (Marshall) ! Craig-na-lochan ! Corrie Ardran ! Ben Laoigh ! 90. Forfar: Clova ! 92. S. Aberdeen: Loch-na-Gar (Marshall). 94. Banff: Cairngorm (Marshall). 96. Easterness: Cairngorm (Marshall). 98. Argyll: Kingshouse (Bucknall). 106. E. Ross: Ben Wyvis (Marshall). 108. W. Sutherland: Ben Hope and Ben Loyal (Marshall). 112. Shetland: Grasswater, No. 1124 (as *E. nemorosa*) (Beeby).

General Distribution. Labrador. Greenland. Iceland. Faroes. Scandinavia. Finland. North Russia. Siberia (at least as far east as the river Tunguska). This species is possibly circumpolar.

4. EUPHRASIA FOULAENSIS Townsend ex Wettstein, *l. c.* 139 (1896); Townsend, *l.c.* 422 (1897). *E. atropurpurea* (Rostrup) Ostenfeld, Bot. Faroes, i, 55 (1901). [Pl. 27, figs. *f–h*.]

Icones. Wettst. *l. c.* tab. xii, ff. 7 & 8 ; Journ. Bot. tab. 376.

Exsicc. Beeby, Hammerfeld, Foula (No. 399), Vord Hill (No. 634) and Ollaberry (No. 633), Shetland, in Hb. Townsend ; Marshall, Nos. 1849, 1853, 1857, 2401, 2402, and 2405 ; Shoolbred, No. 484 ; Johnston, No. 330.

Stem erect, *rather slender*, 5–12 cm. high, reddish and clothed with crisped, deflexed, whitish hairs, *with lower leaves usually about as long as the internodes* (or shorter), and not readily caducous, and upper leaves more crowded ; flowering from the 3rd to the 8th (often 6th) pair of leaves; often simple, but *sometimes with a few short, erect branches. Leaves rather broad*, deep green, ± spreading, the largest commonly about 7 mm. long; cauline oval to broadly obovate, with 1–3 ascending, blunt teeth on each side of a broad, very obtuse or subtruncate terminal lobe ; floral similar to upper cauline or rather broader, less obtuse, with 3–5 acute teeth; *all ciliate with minute bristles*, sometimes with scattered longer hairs on both surfaces. Calyx pubescent with minute bristles, with short teeth which become broad and subacute, accrescent in fruit. *Corolla small*, dorsally 5–7 mm. long, typically *violet*, with a yellow spot on the lower lip and ± distinct dark purple lines ; upper lip with small, retuse, porrect lobes ; *lower lip usually rather longer than the upper*, with three broad emarginate subequal lobes. *Capsule* large and broad, 5–7 mm. long, *elongate-elliptic, emarginate*, or more rarely retuse, sometimes pilose above as well as ciliate, often much exceeding the calyx-teeth.

form. nov. *condensata*. [Pl. 27, fig. *i*.]

Exsicc. Johnston, Nos. 266 (typus), 1273.

Nana, 2–5 cm. alta, sæpe paulo ramosior, foliis plus minusve carnosis caulis ramorumque apicem versus confertis prædita.

Dwarf, 2–5 cm. high, often rather more branched, with ± fleshy leaves crowded above on stem and branches.

β. *maritima* var. nov. [Pl. 27, fig. *j*.]

Exsicc. Pugsley, No. 437 (typus); Marshall, Nos. 2408 and 4112 partim.

Robustior, 5–8 cm. alta, sæpe ramis æquilongis erectis gracilibusque prædita; folia carnosa, parce hirsuta, inferiora facile caduca, floralia inferiora orbicularia vel etiam latiora quam longa, atque inferne cordata; calycis dentes tandem latissimi, obtusi; corolla albida.

More robust, 5–8 cm. high, often with relatively long, erect, slender branches; leaves fleshy, with scattered hairs, lowest readily caducous; lower floral orbicular or sometimes broader than long and cordate below; calyx-teeth very broad, at length obtuse; corolla whitish.

E. foulaensis is allied to *E. latifolia* Pursh, which it somewhat resembles in the elliptical, emarginate form of its large capsule. It differs in its stiffer and more compact habit, its more leafy stem, and its smaller eglandular floral leaves with less deeply cut and acute teeth; the violet colour of its corolla is also characteristic. The form of its capsule, together with its more compact habit and broader leaves, readily separates it, when normal, both from *E. micrantha* and *E. scotica*; but starved individuals are at times difficult to determine. From *E. minima* it may be distinguished by its higher branching, generally different hair-clothing, differently coloured (not yellow) corolla with larger lower lip, and large, often more deeply emarginate capsule. The variety *maritima*, which is very distinct in habit, is perhaps, the result of crossing with *E. Marshallii*.

This species was described by Wettstein from four gatherings in Herb. Townsend, collected in Shetland by the late W. H. Beeby. These exsiccata, it is understood, were not mounted when seen by Wettstein, and the specimens from Burrafiord have unfortunately been subsequently mixed, apparently with examples of *E. scotica* from Scandinavia. This latter set has therefore been omitted from those cited above.

E. foulaensis, which is a plant of moist sea-cliffs and coastal pastures, appears to be confined to Scotland and the Faroes. It is recorded by Praeger (Tourist's Flora, p. 172) from Croaghaun, Achil Island, in the West of Ireland, but the specimen from this station in Herb. Mus. Brit. is insufficient for certain determination. It grows chiefly in the Shetlands and Orkneys, and the adjacent coasts of Sutherland and Caithness, often as the dwarf form *condensata*. The variety *maritima*, remarkable for its broad leaves and white flowers, has been collected by Marshall at Melvich, and on Mainland, Orkney, and by myself near Thurso. The exsiccata

Marshall, No. 2086, from Nairn (as *E. latifolia*), is mostly a white-flowered form of *E. foulaensis*, differing from var. *maritima* only in habit.

In Shetland, and probably in Orkney, *E. foulaensis* appears to cross freely with *E. borealis* and perhaps *E. brevipila*, producing eglandular plants of intermediate habit, often with large, purple corollas (Burdon, Cunningsburgh, and Loch Asta, Mainland, 1921). It also probably hybridises with *E. occidentalis*. The status of these forms needs investigation.

The vice-counties known for *E. foulaensis* are :—

96. Nairn (Marshall). 108. W. Sutherland: Melvich (Marshall). 109. Caithness : Thurso—var. *maritima* ! 110. Outer Hebrides : N. Uist (Shoolbred). 111. Orkneys (Johnston). 112. Shetlands (Beeby).

SERIES II. NEMOROSÆ.

Plantæ sæpissime robustæ, autumnales, et (*E. rotundifoliâ* et *E. occidentali* partim exceptâ) foliis numerosis multo ramosæ. Folia hirsuta vel subglabra, rarius breviter glandulosa. Corolla vulgo parva nisi in *E. Pseudo-Kerneri*, labio inferiore superius superante.

5. EUPHRASIA ROTUNDIFOLIA Pugsley in Journ. Bot. lxvii, 224 (1929). *E. latifolia* auct. angl. (ex parte), non Pursh nec Wettstein nec L. [Pl. 28, figs. *a–d*.]

Exsicc. Marshall, Nos. 1850 (partim) (typus in Hb. Mus. Brit.), 4115 (partim), 4116 (partim); Shoolbred, No. 485 (partim), omnia ut *E. latifolia*.

Caulis erectus, strictus, *robustus*, 5–10 cm. altus, rubescens, setis crassis crispulis deflexis albidis ad basin dense vestitus, *foliis caulinis internodos breviusculos subæquantibus* et floralibus valde imbricatis præditus ; e foliorum pare fere septimo florens ; simplex vel sæpius *e nodis caulinis superioribus paucos ramos brevissimos emittens*. *Folia lata*, crassa, obscure viridia, in sicco nigricantia, opposita, subpatentia, maxima ad 7 mm. longa ; caulina *ovalia ad late ovata vel orbicularia*, utrinque 1–3 dentibus ovato-rotundatis *crenata*, lobo apicale obtusissimo multo latiore quam longo ; floralia similia utrinque 3–4 dentibus apiceque minus obtuso ; omnia, præsertim in paginâ inferiore, longitudinis variabilis setis albidis basin versus incrassatis *dense hirsuta*. Calyx ut folia setosus, dentibus brevibus triangularibus præditus, fructifer accretus. *Corolla parva*, dorso circa 6 mm. longa, externe utrinque villosa, *albida* striis violaceis plus minusve picta, in labio inferiore luteo-maculata; labio superiore lobis brevibus emarginatis porrectis; *labio inferiore superius superante*, lobis emarginatis trilobo, lobo medio apice dilatato lateralibus longiore. *Capsula* majuscula, 6–8 mm. longa, *oblongo-elliptica*, *retusa*, præter marginem ciliatum fere glabra, calycis dentes breves superans.

Stem erect, strict, *robust*, 5–10 cm. high, purplish, densely clothed to the base with stout, crisped, whitish bristles, with *cauline leaves subequalling the rather short internodes* and the floral densely imbricated ; flowering from about

the 7th pair of leaves; simple or more often *with a few very short, erect branches from the upper flowerless nodes. Leaves broad* and thick, dull green, blackening when dry, all opposite, ± spreading, the largest about 7 mm. long; cauline *oval to broadly ovate or orbicular, crenate* with 1–3 rounded-obtuse teeth on each side, and a very obtuse apical lobe much broader than long: floral similar with 3–4 teeth and a less obtuse apex; all *densely hirsute,* especially below, with stout-based white bristles of variable length. Calyx similarly clothed, with short, triangular teeth, accrescent in fruit. *Corolla small,* dorsally about 6 mm. long, villous externally above and below, *white* with ± distinct dark lines and a yellow spot on the lower lip; upper lip with short, emarginate, porrect lobes; *lower lip exceeding the upper,* with emarginate lobes, the median apically dilated and longer than the two lateral. *Capsule* large and broad, 6–8 mm. long, *oblong-elliptic, retuse,* nearly glabrous except the ciliate margin, exceeding the short calyx-teeth.

This plant, which differs widely from the preceding species in its very obtusely cut and densely hirsute foliage, appears in most of Marshall's and Shoolbred's gatherings at Melvich which were named *E. latifolia,* and has been mixed by the collectors with the larger, more branched form, with which it grows in company, now to be described as *E. Marshallii.* The two forms were probably not distinguished owing to both being conspicuously hirsute as well as white-flowered, and at Melvich, *E. rotundifolia* seems to be rather later in flowering, so that it might have been taken for young material of the other. The branching of *E. rotundifolia* somewhat resembles that of *E. foulaensis,* but the former is a more leafy-stemmed and later flowering plant, and densely hirsute, and as it thus approaches *E. Marshallii* and *E. curta,* it is placed among the *Nemorosae* rather than the *Latifoliæ.* In some respects it seems akin to *E. mollis* Ledebour, found on both sides of Behring's Strait, which is also hairy with obtusely cut leaves, but *E. mollis* differs in its less leafy stem, more closely toothed foliage, and still smaller flowers.

A remarkable form (Marshall, No. 1856, as *E. latifolia* f. *grandiflora* Wettst.) was collected at Bettyhill, Sutherland, in 1897 by Messrs Marshall and Shoolbred, which in habit and foliage seems intermediate between *E. rotundifolia* and *E. Marshallii.* It differs from both, however, in its large, lilac-tinted corolla, which is about 10 mm. long dorsally, with a narrow upper lip with relatively long, porrect lobes, and the lower lip far longer, with its median lobe deeply emarginate and much exceeding the lateral ones. The status of this plant, collected at a single station on one occasion only, cannot be satisfactorily judged, but it has the general aspect of a hybrid between *E. rotundifolia* and *E. brevipila.*

Another large-flowered plant, apparently connected with *E. rotundifolia,* rather more branched than the Bettyhill form and with a white, more broadly lipped corolla, was collected at Thurso in 1902 by Rev. H. J. Riddlesdell. This has the aspect of a hybrid *E. rotundifolia* × *borealis.*

E. rotundifolia seems to be endemic to Britain and, in its typical form, is known at present only from sea-cliffs in the neighbourhood of Melvich, Sutherland. It has also been collected by Beeby in Shetland (Nos. 1174 and 1190), where it occurs as a slenderer plant with smaller foliage. I have seen no examples from Orkney.

Some of the material from the Faroes and Iceland referred to *E. curta* or *E. latifolia* may also belong here, but it has not been possible to confirm this from the exsiccata examined.

6. EUPHRASIA MARSHALLII Pugsley in Journ. Bot. lxvii, 224 (1929). *E. latifolia* auct. angl. (ex parte), non Pursh nec Wettstein nec L. [Pl. **28**, figs. *e–g*.]

Exsicc. Pugsley, No. 476 (typus); Townsend, No. 1184, Melvich, ut *E. curta*; Marshall, Nos. 1845, 1850 (partim), 2395, 2399, 4114, 4116 (partim), 4117, omnia ut *E. latifolia*; Shoolbred, No. 485 (partim), ut *E. latifolia*; Johnston, No. 1843, ut *E. latifolia*.

Caulis erectus, *robustus*, 5–15 cm. altus, rubescens, pilis longis crispulis deflexis albidis dense vestitus, *foliis caulinis internodos vulgo subæquantibus* et floralibus plus minusve dense imbricatis præditus; e foliorum pare septimo ad decimo florens; sæpius *ramis longis erecto-patentibus fere e basi valde ramosus*; rami foliis caulinis parvis remotis sed floralibus dense imbricatis præditi, nonnunquam iterum ramosi. *Folia* (caulis) *sæpe magna* (ad 14 mm. longa), crassiuscula, obscure viridia, haud patentia, inferiora facile caduca; caulina ovalia vel rhomboidalia ad obovata, infra cuneata, utrinque 1–5 dentibus obtusis et lobo apicale obtuso prædita; floralia late ovata, vix cuneata, obtusa, utrinque subacute 5–6 dentata; ramorum folia magis dentata, floralia interdum acuta; *omnia* pilis brevibus ad longis undulatis utrinque cum marginibus *dense hirsuta*. Calyx ut folia pilosus, dentibus longiusculis acutis, fructifer accretus. *Corolla satis parva*, dorso 6–7 mm. longa, externe plus minusve villosa, *albida* striis violaceis plus minusve picta, in labio inferiore luteo-maculata; labio superiore lobis brevibus denticulatis; *labio inferiore superius superante*, lobis emarginatis trilobo, lobo medio quam lateralibus angustiore longiore. *Capsula* magna, lata, 6–8 mm. longa, *oblongo-elliptica*, *retusa*, ciliata et superne plus minusve pilosa, calycis dentes æquans vel superans.

Stem erect, *robust*, 5–15 cm. high, purplish, densely clothed with long, deflexed whitish hairs, with *cauline leaves* usually *subequalling the internodes* and the floral ± densely imbricated; flowering from the 7th–10th pair of leaves; often *much branched with long, erect-spreading branches nearly from the base*; branches with small, distant cauline leaves and closely imbricated floral leaves, occasionally again branched. *Leaves* of stem *large* (up to 14 mm. long), rather thick, dull green, not spreading, the lower readily caducous; cauline oval or rhomboidal to obovate, cuneate below, with 1–5 obtuse teeth on each side and an obtuse apical lobe; floral broadly ovate, scarcely cuneate, obtuse, with 5–6 subacute teeth; leaves of branches more deeply toothed, with teeth of floral ones sometimes acute; *all densely hirsute* on margins and both surfaces with short and long, waved, strong, whitish bristles. Calyx densely hirsute like the leaves, with rather long, subacute teeth, accrescent in fruit. *Corolla rather small*, dorsally 6–7 mm. long, ± villous externally, *white* with ± distinct dark lines and a yellow spot on the lower lip; upper lip with short, denticulate lobes; *lower lip exceeding the upper*, with emarginate lobes, the median narrower but longer than the lateral. *Capsule* large and broad, 6–8 mm. long, *oblong-elliptic*, *retuse*, ± pilose above as well as ciliate, equalling or exceeding the calyx-teeth.

β. *pygmæa*, var. nov. [Pl. 28, fig. *h*.]

Exsicc. Burdon, Scalloway, in Hb. Mus. Brit., ut *E. foulaensis* (partim); Johnston, No. 529 (typus).

Nana, 2–5 cm. alta, sæpissime ramosa, foliis parvis confertis prædita. Calyx minimus fructifer accretus. Corolla lilacina vel purpurea, quam in typo haud minor, tubo quam calycis dentibus plane longiore prædita. Capsula calyce vulgo longior.

Dwarf, 2–5 cm. high, usually branched, with small, crowded foliage. Calyx very small, accrescent in fruit. Corolla lilac or purple, as large as in the type, with tube distinctly longer than the calyx-teeth. Capsule generally longer than the calyx.

E. Marshallii is remarkable, like the preceding species, for its coarse and dense hair-clothing, and is probably most nearly allied to *E. curta* Fr., from which it differs by its coarser habit, with straight-based, erect-spreading rather than ascending branches, by its larger and more cuneate-based foliage with much coarser hair-clothing, by its more accrescent calyx with broader, subacute teeth, and by its larger capsules. *E. rotundifolia* is distinguishable by its short but higher branches, subrotund leaves with still coarser hair-clothing, and shorter calyx-teeth. *E. latifolia*, with which this plant was first identified, is usually a lax ,much less hairy plant, with distant lower leaves, unbranched, or at most with only two or three short basal branches. Sometimes, however, it is shorter and more compact, though not more branched, and then it may show some resemblance to *E. Marshallii* in the form of its leaves. Otherwise it seems a widely different species, alike in habit, hair-clothing, flowers, and fruit. The plant treated as a variety *pygmæa* looks very distinct from the Sutherland type, but seems to have the same essential characters except the colour of the corolla.

E. Marshallii, although previously collected (Oliver in Hb. Kew, Far-out Head, 1856), was first brought to notice by Marshall in 1896 and referred to *E. latifolia* by Wettstein, as already explained. This identification does not appear to have been hitherto questioned. In commemorating the late Rev. E. S. Marshall in its name, it may be pointed out that without his fine series of exsiccata in this genus, superior to nearly all other British examples, the present revision could hardly have been written.

Like *E. rotundifolia*, *E. Marshallii* must apparently be regarded as an endemic British species. It occurs on grassy cliffs in a number of places along the coast of West Sutherland and Caithness, from Durness eastward to Reay. At Melvich the typical species grows not only with *E. rotundifolia*, but with another taller, much branched form, with relatively smaller foliage, that has the aspect of a hybrid with *E. curta*, which is also found in the vicinity. *E. Marshallii* has also been collected as a slenderer, unbranched form in Orkney.

The peculiar condensed variety *pygmæa* is at present known in its extreme form only from Shetland, but a larger-flowered and slightly laxer plant collected at Stromness, Orkney, by Col. Johnston in 1919, seems identical with it, as may also be other material obtained in the same locality in 1912. Another somewhat similar form was found at Reay in 1902 by Rev. H. J. Riddelsdell.

7. EUPHRASIA CURTA Fries ex Wettstein, *l. c.* 128 (1896); Townsend, *l. c.* 417 (1897); Jørgensen, *l. c.* 160 (1919). *E. officinalis* var. *curta* Fries, Fl. Halland. 104 (1819); *E. nemorosa curta* Chabert, *l. c.* 273 (1902). [Pl. 29, figs. *a*, *b*.]

Icones. Reichb. Fl. Germ. and Helv. xx, tab. mdccxxxii, f. 6; Wettst. *l. c.* tab. vii, f. 11; Journ. Bot. tab. 375; Jørgensen, *l. c.* tab. xiv, ff. *c-g*.

Exsicc. Fries, Hb. Norm. iv, 26; Schultz, Hb. Norm. 1111 and 1111 bis, as *E. parviflora*; Dörfler, Hb. Norm. 3357; Wheldon, Ramsay, 1917, in Hb. Mus. Brit.; Marshall, No. 4045.

Stem erect, *moderately robust* or rather slender, 5–35 cm. high, usually purplish, ± densely clothed with longish, deflexed, crisped, white hairs, *with cauline leaves*, at least the lower, *usually longer than the short internodes*, and the floral leaves shorter in a lax spike; flowering from about the 7th pair of leaves; generally *branched low on the stem with long, slender, ascending* or erect *branches*, rarely again branched. *Leaves rather small* (up to 10 mm. long), numerous, greyish-green, strongly nerved below when dry, generally spreading, lower readily caducous; lower cauline leaves oblong, cuneate below, obtuse, with 1–3 obtuse teeth on each side; upper cauline oval or narrowly ovate, less cuneate, acute, with 3–5 acute teeth; floral broader but shorter than upper cauline, ovate-rotundate, acute or cuspidate, with 5–6 deep, acute or aristate teeth; leaves of branches rather smaller and narrower with finer teeth; all ± *densely hirsute* on margins and both surfaces with long, waved, whitish hairs (or with scattered or short hairs only on margins and nerves below—var. *glabrescens* Wettst.). Calyx clothed like the foliage, with rather short but finely acuminate teeth, scarcely accrescent, but sometimes inflated in fruit. *Corolla small*, dorsally 5–6 mm. long, normally *white*, with a yellow spot on the lower lip and distinct dark lines; upper lip with retuse, porrect or reflexed lobes; *lower lip exceeding the upper*, with three nearly equal, emarginate lobes. *Capsule* small or of medium size, 4·5–5·5 mm. long, *oblong*, *rounded-truncate* or slightly retuse, pilose above as well as ciliate, subequalling the calyx-teeth.

f. *littoralis* Neuman, Sveriges Flora, 141 (1901). [Pl. 29, fig. *c*.]

Exsicc. Johansson, Hvellinge, 1887, and Kivik, 1911, in Hb. Mus. Brit.; Marshall, Nos. 3110 and 4199.

Short and robust (usually not more than 10 cm. high), becoming much branched and bushy, with closely set leaves.

β. piccola, var. nov.

E. curta f. *piccola* Townsend ap. Trail in Ann. Scot. Nat. Hist. 177 (1902); Journ. Bot. xl, 362 (1902).

Exsicc. Beeby, No. 1199, S. side of Hjogo, Unst, Shetland, 1897, in Hb. Beeby.

Stem slender, 2·5–3 cm. high, unbranched, or taller (up to 8 cm.), with several short branches. Leaves numerous, very small (about 3 mm. long), strongly hirsute. Corolla extremely small, dorsally 3–4 mm. long, white and strongly striate, with short lower lip. Capsule rather broader than in the type.

γ. rupestris, var. nov. [Pl. 29, figs. *d–f*.]

Exsicc. Pugsley, No. 429.

Caulis gracilis, 5–10 cm. altus, e foliorum pare quinto vel sexto florens, simplex aut duo tresve ramos basales emittens. Folia parva, ad 6 mm. longa, viridia, quam in typo angustiora et parcius obtusiusque dentata, floralia inferne plus minusve cuneata. Corolla quam typi minor. Capsula 4–4·5 mm. longa, retusa.

Stem slender, 5–10 cm. high, flowering from the 5th or 6th pair of leaves, simple or with two or three erect basal branches. Leaves small, the largest about 6 mm. long, green, narrower and with fewer, less acute teeth than in the type, the floral ± cuneate below. Corolla smaller than in the type. Capsule 4–4·5 mm. long, retuse.

E. curta is typically a well-marked species, readily known by its branched and leafy habit, grey-green, hairy but eglandular foliage, small white flowers and small capsules. The only other species that are equally hirsute are *E. rotundifolia* and *E. Marshallii*, whose differentiating characters have already been indicated. In some features *E. curta* closely resembles *E. nemorosa*, under which the relations of the two plants will be discussed.

In Britain *E. curta* is an uncommon plant in all its forms. The best British material of the type that has been seen is that collected by Wheldon at Ramsay, Isle of Man. This closely resembles many of the Scandinavian exsiccata, which are generally fairly uniform in herbaria, and clearly conspecific with the dwarf and young examples originally sent out by Fries and constituting the specific type. This typical form is probably widely scattered in Scotland, and occurs in the Lancashire sand-dunes mixed with *f. littoralis*. In North Wales the type is also found, with f. *littoralis* on the Anglesea sand-dunes and var. *rupestris* on rocky slopes of the Snowdonian mountains.

Townsend's form *piccola* was described from material collected by Beeby in Unst, Shetland, and a specimen from Nigg, Kincardineshire, and another from near Bethesda, Carnarvonshire, were identified with it. These two latter plants, however, are not identical, the first being a dwarf form of typical *E. curta* with fair-sized flowers, and the other young examples of var. *rupestris*. The Shetland type is a very distinct plant, remarkable for its minute flowers, and at least separable as a variety. It is no doubt identical with other larger specimens found in the same neighbourhood in Unst, and differs but little from Ostenfeld's Faroes material of *E. curta* (which has more obtusely cut foliage) and that collected in Iceland by Miss L. S. Gibbs and now in Herb. Mus. Brit.

The variety *rupestris* is also very distinct, smaller than the type in all its parts and with narrower foliage. In its green colour, very small flowers and retuse capsules it shows an approach towards *E. cambrica*, which grows in the same district, and when more thoroughly known, it may prove to be closely connected with that species. On the whole, however, it seems best placed at present as a variety of *E. curta*.

The name var. *glabrescens* Wettst. seems really to indicate nothing more than a subglabrous state that may occur in any form of *E. curta*, and is therefore not adopted. It has been applied in Britain to a number of glabrescent forms of various Eyebrights, and is no doubt properly applicable to some of the Lancashire sand-dune forms of *E. curta*, but I think it has been wrongly used for other more robust and slightly hairy coast-forms, with coarse foliage and calyx-teeth, which are probably of hybrid origin between *E. curta* and either *E. nemorosa* or *E. borealis*. The plant that I distributed from Criccieth (Pugsley, No. 412) falls under this category.

Jørgensen gives no varieties of *E. curta* for Scandinavia, but he reports it to hybridise both with *E. brevipila* and with *E. stricta*; and numerous examples apparently of this nature have been noted in herbaria. Certain Scottish forms also seem to be *E. curta* × *brevipila*.

In Britain *E. curta* grows chiefly on grassy mountain slopes and near the sea. It has been noted from Glengariff, in Ireland, and from the following vice-counties in Great Britain :—

4. N. Devon : Braunton—f. *littoralis* (Marshall). 6. N. Somerset : Berrow—f. *littoralis* (Marshall) ! 41. Glamorgan : Welsh St. Donat's—f. *littoralis* (Riddelsdell). 44. Carmarthen : Pembrey—f. *littoralis* (Marshall). 45. Pembroke : Newgale—f. *littoralis* (Linton). 46. Cardigan : Aberarth—f. *littoralis* (Marshall). 49. Carnarvon : Glydyrs—var. *rupestris* ! 52. Anglesea : Holyhead (Melvill). Aberffraw—f. *littoralis* ! 60. W. Lancs : Lytham (Melvill). St. Ann's—with f. *littoralis* (Bailey). 68. Cheviotland : Bamborough—f. *littoralis* (Fox). 71. I. Man : Ramsay (Wheldon). 87. W. Perth : Ben Laoigh (Hb. Bucknall). 90. Forfar : Clova ! 91. Kincardine : Nigg (Trail). 92. S. Aberdeen : Mar Forest (Marshall). 95. Elgin : Kingston (Marshall). 97. Westerness : Morar (Townsend). 98. Argyll : Moidart (Macvicar). 108. W. Sutherland : Tongue and Melvich (Marshall). 112. Shetland : Unst—var. *piccola* (Beeby).

General Distribution. Scandinavia. Denmark. Finland. West Russia. North and East Germany. North-east Bohemia. Holland (ap. Jørgensen). West France, Brittany (ap. Chabert). Faroes. Iceland.

Jørgensen questions its occurrence in Iceland, but Miss Gibbs's specimens, determined by Ostenfeld, seem clearly to belong here, and some of them are almost identical with the Shetland var. *piccola*.

Chabert records *E. curta* for North America, and this seems to be confirmed by Canadian exsiccata (*E. latifolia*, Grand River, Gaspé, Quebec, Coll. Collins, Fernald and Pease, 1904), which is scarcely distinguishable from the variety *piccola*.

8. EUPHRASIA CAMBRICA Pugsley in Journ. Bot. lxvii, 224 (1929). [Pl. **29**, figs. *g–k*.]

Exsicc. Pugsley, Nos. 430, 431, 432 (typus).

Planta nana. Caulis adscendens, gracilis, flexuosus, vulgo 1–2·5 (raro ad 6) cm. altus, viridiusculus, pilis longis deflexis crispulis albidis vestitus, *foliis internodos breves* normaliter *superantibus* præditus ; fere e foliorum pare quarto florens ; *ramis flexuosis gracilibus infra* sæpissime *ramosus*. *Folia relative haud parva* (ad 5 mm. longa vel raro longiora), numerosa, læte viridia, patentia, raro caduca ; caulina oblonga ad obovata, infra plus minusve cuneata, utrinque dentibus 1–3 obtusis et sæpius haud profundis rotundato-obtusa ; floralia latiora, magis ovata, utrinque 3-rarius 4-dentibus subacutis obtusa vel subacuta ; omnia *pilis albidis* (in pagina superiore sæpe rarioribus brevioribusque) utrinque cum marginibus *parce hirsuta*. Calyx ut folia hirsutus, dentibus acuminatis, fructifer accretus. *Corolla minima*, dorso 4–5 mm. longa, *albida* striis violaceis plus minusve notata, labio inferiore stramineo, superiore nonnunquam violaceo-tincto ; tubo quam labiis longiore ; labio superiore lobis subintegris porrectis vel reflexis ; *labio inferiore quam superiore vix longiore*, lobis retusis emarginatisve anguste trilobo, lobo medio lateralia superante. *Capsula* relative magna et lata, circa 5 mm. longa, *elliptica, emarginata*, ciliata et superne breviter pilosa, calycis dentibus longior.

Plant dwarf. Stem ascending, slender, flexuous, usually 1–2·5 (occasionally –6) cm. high, greenish, clothed with long, deflexed, crisped, white hairs, with *leaves normally exceeding the short internodes* ; flowering from about the fourth pair of leaves ; generally *branched below with slender, flexuous branches. Leaves relatively not small* (up to 5 mm. long or occasionally longer), numerous, bright green, spreading, rarely caducous ; cauline oblong to obovate, ± cuneate below, rounded-obtuse with 1–3 obtuse and generally shallow teeth on each side ; floral broader, becoming ovate, obtuse or subacute, with 3, more rarely 4 subacute teeth ; all *hirsute with scattered whitish hairs* on the margins and both surfaces (hairs often fewer and shorter on the upper side). Calyx clothed like the foliage, with acuminate teeth, accrescent in fruit. *Corolla very small*, dorsally 4–5 mm. long, *whitish* ± marked with dark lines, the lower lip tinted with pale yellow and the upper occasionally with violet ; tube longer than the lips ; upper lip with subentire, porrect or reflexed lobes ; *lower lip scarcely longer than the upper*, with three narrow, retuse or emarginate lobes, the median exceeding the lateral. *Capsule* relatively large and broad, about 5 mm. long, *elliptical*, *emarginate*, shortly pilose above as well as ciliate, longer than the calyx-teeth.

This inconspicuous Eyebright is readily distinguished by its very dwarf, branched habit, green hairy foliage, minute flowers and large, broad capsules. It is probably most nearly related to *E. curta* and *E. confusa*, but its habit and capsules separate it from small forms of the former, and from the latter it clearly differs by the same features as well as by its hirsute leaves and much smaller flowers. Its corolla recalls that of *E. scotica*.

E. cambrica is widely distributed over the mountains of Carnarvonshire, where it usually grows among mosses on steep grassy slopes or rock-ledges, and is easily passed unnoticed owing to its very small flowers. It generally occurs at higher altitudes than *E. curta* var. *rupestris*, and ascends almost to the summit of Snowdon. In 1922 I collected it on Snowdon, in Cwms Idwal and Bochlwyd, and on Ysgolion Duon; in 1925 in Cwm Clwyd. It was also found by Miss Armitage and Mr. Wheldon on Snowdon in 1919, and in 1924 by Mr. Sherrin on ledges under Glydyr Fach, where it was remarkably luxuriant. In Herb. Bucknall there are specimens collected in 1918 on Snowdon and on Moel Siabod, and named *E. minima* var. *arbuscula* Bucknall, although obviously different from the Patterdale type of that variety. In Wales *E. cambrica* seems to take the place occupied by *E. latifolia* in Scotland. Material collected by Mr. Ridley in 1881 on the Kirkstone Pass, Westmoreland, also appears to belong to *E. cambrica*, which will perhaps be found in other localities in the English Lake District. A noteworthy form occurs in the Snowdon district which has the aspect of a hybrid with *E. scotica*.

No material approaching this species has been seen from any Scottish or foreign locality.

9. EUPHRASIA OCCIDENTALIS Wettstein, *l.c.* 135 (1896); Townsend, *l.c.* 419 (1897); Bucknall, Brit. Euphr. 9 (1917). *E. nemorosa occidentalis* Chabert, *l.c.* 274 (1902); *E. nemorosa* var. *occidentalis* Rouy Fl. Fr. xi, 154 (1909). [Pl. 30, figs. *a*, *b*.]

Icones. Wettst. *l.c.* tab. xi, f. 13; Journ. Bot. tab. 375.

Exsicc. Marshall, Nos. 1308, 2060, 3408; Cunnack, Kynance, 1879, as *E. officinalis* var. *tetraquetra*; J. Groves, Hayle, 1880, in Hb. Towns., as *E. officinalis* var. —; Thompson, Land's End, 1880, as *E. maritima*; Rilstone, Perranporth, 1922, and Polperro, 1926.

Stem erect, *robust*, 5–15 cm. high, purplish, ± densely clothed with deflexed, crisped, white hairs of varying length, with *cauline leaves usually longer than the short internodes* (lowest often very short), and floral leaves, which are sometimes shorter, in a dense, often imbricated spike; flowering from about the 8th pair of leaves; generally *branched with ascending or suberect, stout branches*, which are sometimes numerous and occasionally again branched. *Leaves*, at least the upper cauline, *often rather large* (up to 13 mm. long), numerous, dull green, thick with ± revolute margins, not spreading, lower very readily caducous; cauline oblong-obovate to obovate, with 1–3 (more rarely –5) flattened, obtuse teeth on each side of the rounded-obtuse apex, upper sometimes much larger than the lower and earlier; floral shorter than the upper cauline, broadly ovate, lower obtuse, upper acute, with 3–5 obtuse, acute or more rarely acuminate teeth, rounded or truncate below, or the uppermost ± cuneate; all *clothed with short or longer whitish hairs and shortly stalked glands*, the hairs or the glands, or occasionally both, being sometimes nearly obsolete. Calyx clothed like the foliage, with triangular-subulate teeth, somewhat accrescent in fruit. *Corolla small*, dorsally 5–6 mm. long, *white* with a yellow spot on the lower lip and fine, dark lines; upper lip with short, ± retuse, porrect or reflexed lobes; *lower lip exceeding the upper*, with three rather broad, emarginate lobes, the median rather longer than the lateral. *Capsule* rather large, 6–8 mm. long, *oblong* or elliptic-oblong, *truncate* or slightly retuse, pilose above (or glabrous) with ciliate margins, normally exceeding the calyx-teeth.

β. *præcox* Bucknall, Brit. Euphr. 10 (1917). [Pl. 30, fig. *c*.]

Exsicc. White, Polzeath, 1916, in Hb. Bucknall.

Stem 1–4 cm. high, much branched, cæspitose. Foliage with ± numerous glands but very few hairs. Corolla about 5 mm. long, white or tinted with violet.

γ. *minor*, var. nov. [Pl. 30, fig. *d*.]

Exsicc. W. R. Linton, St. David's, 1900, ut *E. occidentalis*; Rilstone, Polperro, 1920, ut *E. occidentalis* var. *præcox* (typus).

Caulis 2–6 cm. altus, paulo gracilis, simplex vel ramis paucis præditus. Folia quam in typo minora, vulgo plus minusve glandulosa sed pilis albidis sparsim vestita. Corolla circa 5 mm. longa, labio superiore sæpe violaceo-tincto. Capsula 5–6 mm. longa.

Stem 2–6 cm. high, rather slender, simple or with few branches. Leaves smaller than in the type, generally glandular, but with few simple hairs. Corolla about 5 mm. long, upper lip often tinted with violet. Capsule 5–6 mm. long.

δ. *calvescens*, var. nov. [Pl. 30, fig. *e*.]

Exsicc. Salmon, Swanage, 1910, in Hb. Mus. Brit., ut *E. borealis* (typus); F. Robinson, No. 108, ut *E.* ——.

Caulis 5–20 cm. altus, ramis paucis curtis sæpius prope basin emissis præditus. Folia pilis glanduliferis et eglanduliferis parcissime vestita, floralia caulinis sæpe majora, in spicâ dense imbricatâ capsulas tegente nonnunquam instructa. Corolla 5–7 mm. longa.

Stem 5–20 cm. high, with few short branches generally from near the base. Leaves with very few hairs and glands, floral often larger than cauline, forming a densely imbricated spike and covering the capsules. Corolla 5–7 mm. long.

E. occidentalis is a somewhat ill-defined species allied to *E. curta* and *E. nemorosa*, but differing from both in the almost constant presence of shortly stalked foliar glands, frequently mixed with short bristles. Its relatively low stature and basal branching are also distinctive, as well as its usually more obtusely cut leaves and its larger capsules. The variety *calvescens* has at times been identified with *E. borealis*, which it somewhat resembles in foliage, but its habit is essentially different and of the late-summer type with short lower internodes and numerous leaves.

The present plant was originally described by Wettstein as a provisional species from material in Herb. Florence which had been collected on the French island of Ouessant, off Brittany. It is a form little known to French botanists, and Chabert does not appear to have seen it, for he cites only Wettstein's original locality. Townsend, however, on the publication of the species referred to Wettstein several gatherings from South-West England, which the monographer confirmed as his *E. occidentalis* (*vide* Townsend, *l. c.*); and as the majority of these exsiccata, which are cited above, are clearly identical and agree with Wettstein's description, they have been taken as authentic material of the typical species, although the actual Ouessant type has not been seen. In France somewhat similar but generally more glabrous coast-forms, which might be referred to *E. occidentalis*, have been treated as *E. nemorosa* var. *tetraquetra* Brébisson.

The varieties *præcox* and *minor* are distinctly smaller plants than the type, as understood above, although in the case of the former the condensed habit is no doubt largely due to exposure. They are both almost confined to the Cornish coast. The variety *calvescens* is more nearly glabrous as a rule, and but little branched, but its calyx and capsule, as well as the form of the leaves, are those of *E. occidentalis*, albeit, when robust, its fruiting spike resembles that of *E. borealis*. It has been met with along the south coast from Hants to Cornwall and North Devon, and also in Anglesea. These three varieties are remarkable for their early flowering; in the South of England they begin to bloom early in May.

In the North of Scotland, as well as the Orkneys and Shetlands, there exist a number of condensed forms that recall this species, but owing to their small size and fleshy foliage, and in some cases to defective drying, it is difficult to ascertain their exact features with certainty, and desirable to examine them *in situ*, if possible, or at least in the living state. Plants from two Scottish vice-counties, however, have been assigned to *E. occidentalis* with some confidence.

With the exception of its original French station, *E. occidentalis* is known only for the British Isles. It is usually a plant of grassy sea-cliffs, but in North Somerset it also grows on the limestone hills of Bleadon and Cheddar, facing but at some distance from the sea. And in West Glo'ster the variety *calvescens* grows at Minchinhampton and Woodchester. In Herb. Townsend there are specimens labelled "near Buxton" (Derbyshire) which seem inseparable from the typical form of this species.

E. occidentalis has been recorded from Ireland, and from the three Channel

Islands, Jersey ! Guernsey ! and Alderney. Its known vice-counties in Great Britain are :—

1. W. Cornwall : Land's End (Thompson). Hayle (J. Groves). Kynance (Cunnack). Porthcurnow ! 2. E. Cornwall : Rame Head—v. *minor* ! 3. S. Devon : Bigbury (Marshall). 4. N. Devon : Lynmouth—v. *calvescens* ! 6. N. Somerset : Bleadon (Bucknall). 9. Dorset : Portland (Marshall). Swanage—v. *calvescens* ! 10. Wight : Bonchurch—v. *calvescens* ! 11. S. Hants : Hayling I. ! 14. E. Sussex : Beachy Head ! 34. W. Glo'ster : Minchinhampton—v. *calvescens* (Riddelsdell). 41. Glamorgan : Sully (Wade). 45. Pembroke : St. David's—v. *minor* (W. R. Linton). 52. Anglesea : Holyhead ! 71. I. Man : Peel—v. *minor* (Wheldon). 97. Westerness : Moidart—v. *calvescens* (Macvicar). 107. E. Sutherland : Golspie !

10. EUPHRASIA NEMOROSA Löhr, Fl. Coblentz, 128 (1838) ; Gremli, Neue Beitrage Fl. Schweiz, iv, 26 (1887) ; Wettst. *l. c.* 118 (1896) ; Townsend, *l. c.* 404 (1897) ; Chabert, *l. c.* 270 (1902). *E. officinalis β. nemorosa* Persoon, Syn. Plant. ii, 149 (1807) ; *E. nitidula* Reuter, Comptes-rendus Soc. Hall. 122 (1854–56). [Pl. **30**, fig. *f*.]

Icones. Bulliard, Herb. Fr. tab. 233 (as *E. officinalis*) ; Wettst. *l. c.* tab. viii, f. 1 : Journ. Bot. tab. 375.

Exsicc. Reichb. Exs. No. 243, as *E. officinalis* ; Billot, 2724 ter, as *E. ericetorum* ; Wirtgen, No. 704 c ; Favrat, Jorat, Lausanne, in Hb. Kew ; Muret, La Dôle, in Hb. Kew, as *E. nitidula* ; Marshall, Nos. 2582, 4195 ; Barton, No. 154 ; Ridley, Brinsop, 1882, in Hb. Mus. Brit., as *E. officinalis* ; Ibbotson, Ganthorpe, 1845, in Hb. Mus. Brit., as *E. officinalis* ; White, St. Leonard's Forest, 1900, in Hb. Mus. Brit.

Stem erect, *moderately robust*, 10–40 (commonly 15–20) cm. high, generally purplish, ± densely clothed with deflexed, crisped, white hairs, with *lower cauline leaves as long or longer than the short internodes*, but the *upper cauline and the floral leaves* (except the uppermost) generally *shorter than the much longer internodes* ; usually not flowering before the 10th pair of leaves ; *with numerous*, long, slender, *erect or ascending branches*, some of which are frequently again branched. *Leaves of moderate size* (up to 12 mm. long), numerous, dark or occasionally purplish green, with nerves ± prominent below when dry, generally spreading and the floral sometimes a little arcuate-recurved, lower readily caducous ; lower cauline leaves oblong or oval, obtuse, with 1–3 ascending, subacute teeth on each side ; upper larger, ovate, subacute, with 3–6 acute teeth ; floral shorter than the upper cauline, ovate, acute, with 4–6 acute or shortly aristate teeth ; leaves of branches commonly smaller and narrower ; all *typically glabrous*, but frequently with some minute marginal bristles, sometimes with scattered longer hairs on the margins and nerves below (var. *ciliata* Drabble). Calyx clothed like the foliage, with acuminate teeth, scarcely accrescent in fruit. *Corolla small*, dorsally 5–6 mm. long, *white* or with bluish upper lip, with yellow spot on the lower lip and dark lines often not strongly marked; upper lip rounded, with small, notched, porrect or reflexed lobes; *lower lip longer*, deflexed, with three emarginate, rather narrow lobes, the median exceeding the lateral. *Capsule* of medium size or small, 5–6 mm. long, *oblong*, *rounded-truncate* or retuse, generally slightly pilose above as well as ciliate, subequalling the calyx-teeth.

β. calcarea, var. nov. [Pl. **31**, fig. *a*.]

Exsicc. Marshall, No. 2579, ut *E. Kerneri*; Pugsley, No. 445 (typus).

Robustior humiliorque quam typus, 5–20 cm. alta, sæpe celerius florens et caulis basin versus ramosa, internodis quam foliis vulgo brevioribus. Folia crassa, raro dentibus aristatis prædita. Calyx fructifer paulo inflatus vel accretus, dentibus latiusculis capsulam sæpius superantibus. Aliter ut in typo.

More robust and lower than the type, 5–20 cm. high, often flowering from an earlier node and branching nearer the base of the stem, with internodes mostly shorter than the leaves. Leaves thick, rarely with aristate teeth. Calyx somewhat inflated or accrescent in fruit, with broader teeth usually exceeding the capsule. Otherwise like the type.

γ. collina, var. nov. [Pl. **31**, fig. *b*.]

Exsicc. Pugsley, No. 477 (typus); Barton, Nos. 481, 483, 488, ut *E. nemorosa* var. *ciliata*; W. T. Dyer, Oakley Park, Glo'ster, in Hb. Mus. Brit., ut *E. officinalis*.

Planta sæpissime typo humilior, 5–30 cm. alta, nonnunquam ramis paucioribus magis patentibus et internodis (præter infimos) quam foliis longioribus prædita, nonnunquam densior et multo ramosa. Folia crassiora, dentibus minus acutis. Calyx fructifer subinflatus. Corolla quam typi major, 6–7 mm. longa, labio superiore vulgo plus minusve cæruleo, inferiore sæpe multo majore. Capsula calycem sæpe superans.

Plant generally shorter than the type, 5–30 cm. high, sometimes with fewer more spreading branches, and internodes, except the lowest, longer than the leaves; but sometimes more compact and much branched. Leaves thicker, with less acute teeth. Calyx rather inflated in fruit. Corolla larger than in the type, 6–7 mm. long, usually with bluish upper lip and often much larger lower lip. Capsule often exceeding the calyx.

δ. sabulicola, var. nov. [Pl. **31**, fig. *c*.]

Exsicc. Pugsley, No. 433.

Planta piccola, caule satis gracili, viridiusculo, 5–10 cm. alto, et 4–8 ramis longis erectis prædita, e foliorum pare sexto vel septimo florens. Corolla minima, alba, dorso circa 4·5 mm. longa, labio inferiore superius vix superante.

Plant small, with rather slender greenish stem, 5–10 cm. high, and several long, erect branches, flowering from the 6th–7th pair of leaves. Corolla very small, white, dorsally about 4·5 mm. long, with lower lip scarcely exceeding the upper.

c. *transiens*, var. nov. [Pl. 31, fig. *d.*]

Exsicc. Marshall, No. 4447, ut *E. curta* var. *glabrescens*; F. Robinson, No. 416, ut *E.* —— ; Pugsley, No. 446 (typus).

Planta habitu laxo gracilique, ad 40 cm. alta (vel rarius nana compacta), ramis longis flexuosis et foliis relative parvis obscure viridibus quam internodis multo brevioribus (floralibus summis exceptis) prædita. Folia floralia sæpius arcuato-recurvata. Corolla quam typi sæpissime major, circa 6 mm. longa, plus minusve violaceo- vel purpureo-tincta, valde striata. Capsula folio subtendente sæpissime longior.

Of lax and slender habit, up to 40 cm. high (more rarely dwarf and compact), with long, flexuous branches and relatively small, dull green leaves much shorter than the internodes, except the highest floral. Floral leaves often arcuate-recurved. Corolla generally larger than in the type, about 6 mm. long, ± tinted with violet or purple and strongly striate. Capsule usually larger than its subtending leaf.

form. nov. *procumbens.*

Exsicc. Marshall, No. 1838 (typus); Shoolbred, No. 489 ; omnia ut *E. curta* var. *glabrescens.*

Planta nana, decumbens, caule 5-8 cm. longo, internodis infimis fere obsoletis, ramis brevibus patentibus foliisque rubro-tinctis prædita.

Dwarf and decumbent, with stem 5–8 cm. long. Lowest internodes almost obsolete, branches short and spreading, leaves tinted with red.

E. nemorosa is a species of which no true type is known to exist, and it is therefore necessary, if the name is to be kept up, to follow Wettstein's conception of the plant intended, as he was the first to describe it in detail and figure it accurately. As explained by Wettstein, the name is taken from Persoon's Synopsis, where it is shown as a variety of *E. officinalis*, and the identity of the plant is based chiefly on Persoon's citation of Bulliard's figure No. 233. It is reasonably certain that this identification is correct, and as *nemorosa* is the earliest distinctive name for the form in question, Wettstein adopted it, in accordance with his usual practice, although a varietal name only, and cited Persoon as the authority for the species. He notes, however, that it was first clearly separated from *E. stricta* by Gremli (Neue Beitrage, i, 18 (1880)). Townsend, in dealing with *E. nemorosa*, cites H. Martius in place of Persoon, for Martius was the first to use the name in a specific sense (Prod. Fl. Mosquensis, 107 (1817)). But Martius's name, which was treated by Wettstein as not meaning only or chiefly the plant with which he was dealing, evidently refers entirely to another form that is not defined, for *E. nemorosa*, in the sense of Persoon and Wettstein, is not known as a Russian plant. Martius cannot therefore be correctly cited. The earliest botanist who clearly distinguished *E. nemorosa* appears to have been M. J. Löhr, who described (*l. c.*) *E. micrantha* Reichb., *E. officinalis* L. (= *E. stricta* Host), *E. nemorosa* Pers., and *E. pratensis* Scheuchz. (= *E. Rostkoviana* Hayne). Löhr's account of these four species is quite explicit and unmistakable, and he is therefore cited above for *E. nemorosa*, the name of Martius not being valid for any definite group.

The varietal name *tetraquetra*, which has been used by French botanists to designate compact coast-forms allied to *E. nemorosa*, both glandular and eglandular, has not been taken up. Brébisson (Fl. Normand. ed. 2, p. 183) describes it as a variety not of *E. nemorosa* but of the glandular *E. officinalis* (= *E. Rostkoviana* Hayne); and Arrondeau, who subsequently founded the species *E. tetraquetra* (Bull. Soc. Polymatique du Morbihan, 96 (1862)), states that his plant is glabrous, with a glandular calyx and reddish corolla. These characters do not agree with any British form.

The question of the occurrence of stalked glands in forms of *E. nemorosa*, apart from hybridity, is of interest, for *E. nitidula* Reuter, which has uniformly been held to be conspecific with *E. nemorosa*, is stated by its author to have leaves "parsémées ainsi que les calices de poils glanduleux." This may not be uniform, and is perhaps the result of crossing, for in its *locus classicus E. nitidula* grows with *E. Rostkoviana*. Grenier (Fl. Jurassique, 568) remarks that he has not seen glandular hairs in *E. nitidula*, and they are not mentioned by Chabert. The material of *E. nitidula* at Kew received from Favrat is also eglandular.

In Britain typical *E. nemorosa*, as understood by Löhr, Wettstein, and other German and Swiss botanists, is not very common. Much of the German and Swiss material in herbaria is uniform and characteristic, showing a tall, freely branched, but not coarse plant, of lax habit, with small, dark, glabrous leaves, distinctly small, white flowers, and small capsules. In English examples that otherwise agree with this form, the corolla frequently tends to be larger. Plants of this nature are scattered throughout England in open woods or banks on sandy or loamy but generally not on calcareous soils. The form occurring on chalk downs and similar situations is normally a dwarfer but coarser plant than the type, with equally small flowers, and seems distinguishable as a variety, *calcarea*. The plant separated as var. *collina* is often a small plant (but sometimes large, luxuriant and much branched) with coarse, rather thick leaves and flowers distinctly larger than in the type. It grows commonly in the hilly districts of Wales, the West and North of England, and southern Scotland, and has sometimes been named *E. Kerneri*. Some exsiccata closely agreeing with this variety are perhaps of hybrid origin. The variety *sabulicola* is remarkably abundant and uniform on the sands of Barrie, Forfarshire, and a somewhat similar plant was collected by Townsend at Morar, Invernessshire, and referred to *E. curta* var. *glabrescens*. This dwarf form grows within the area of *E. curta* in Scotland, as fixed by Wettstein, but it appears to be more closely allied to *E. nemorosa*, and is indeed not very different from a small form of this species that is found in meadows at Samaden, in the Engadine. The last variety, *transiens*, notable for its brightly coloured violet or purplish flowers, combined with small, recurved foliage that recalls *E. Pseudo-Kerneri*, has been seen in various stations from North Wales and Norfolk to Middlesex and Surrey. It has sometimes been mistaken for *E. micrantha*. The Continental form approaching

E. micrantha known as var. *macilenta* Gremli is a slenderer, less branched form according to the exsiccata examined. The plant referred to var. *transiens* f. *procumbens* was collected by Messrs. Marshall and Shoolbred in shell-sand at Tain, E. Ross, and is noticed by Townsend (*l. c.* 475).

The varietal name *ciliata* Drabble (Journ. Bot. liv, 75) is of the same nature as var. *glabrescens* of *E. curta*, and may be applied to any form of *E. nemorosa* with non-glabrous leaves. It has therefore been similarly passed over as a variety.

E. nemorosa is most nearly allied to *E. curta* and is not always readily distinguished. When normal, *E. curta* differs obviously by its grey-green, shaggy foliage and calyx, but at times this hair-clothing tends to obsolescence. On an average *E. curta* is a smaller and slenderer plant than *E. nemorosa*, with smaller leaves more conspicuously veined below, the floral broader and more deeply and finely toothed. The calyx-teeth, too, are commonly finer, and the capsule rather smaller. In some localities plants resembling *E. nemorosa* but with some *curta*-like hair-clothing may be met with. These are presumed to be of hybrid origin. *E. occidentalis*, particularly the variety *calvescens*, may also be confused with *E. nemorosa*, and is best known by its more basal branching, glandular clothing, and longer capsules. *E. stricta* differs by its more erect and strict branching, with long, spreading, aristate teeth to the floral leaves, large lilac-coloured corollas, and small, narrow capsules.

A very remarkable form that seems to be a variant of *E. nemorosa* grows at Bossington, West Somerset, where it was abundant in 1910. It is a tall, much branched plant, with small foliage, a rather large, white corolla with extremely long and narrow lobes to the lower lip, and long, narrow, linear-oblong capsules enclosed in an accrescent calyx with very long linear-subulate teeth. The fruit and calyx recall those of *E. pectinata* rather than any British species.

E. nemorosa probably inhabits woods, heaths, downs or pastures in every county of England and Wales, as well as many in Scotland and some in Ireland. It has been noted for the following vice-counties :—

1. W. Cornwall : Penzance ! 3. S. Devon : Babbicombe ! 4. N. Devon : Woodabay (Fox). 5. W. Somerset : Simonsbath—v. *transiens* (Marshall). 6. N. Somerset : Weston ! 7. N. Wilts : Avebury (Barton). 8. S. Wilts : Stonehenge (Bailey). 9. Dorset : Cranborne (Melvill). 10. Wight : Carisbrooke ! 11. S. Hants : Hayling I. ! 12. N. Hants : Odiham (Palmer). 13. W. Sussex : Lurgashall (Burdon). 14. E. Sussex : Brighton (Thiselton-Dyer). 15. E. Kent : Kingsdown (Catcheside). 16. W. Kent : Dartford (Rimington). 17. Surrey : Box Hill—v. *calcarea* ! Wimbledon—v. *transiens* ! 18. S. Essex : Eastwood (Sherrin). 19. N. Essex : Fordham (Brown). 20. Herts : Broxbourne (Crespigny). 21. Middlesex : Harefield—v. *transiens* ! 22. Berks : Wytham (Riddelsdell). 23. Oxford : Chinnor (I. Williams). 24. Bucks : Amersham—v. *transiens* (Riddelsdell). 27. E. Norfolk : Dubeck ? (A. Bennett). 28. W. Norfolk : Gooderstone—v. *transiens* (Robinson). 30. Beds : Pegsdon—v. *calcarea* (Little). 31. Hants : Kimbolton (Fernie). 32.

Northants : Yardley (Shepherd). 33. E. Glo'ster : Cranham (Bailey). 34. W. Glo'ster : Marshfield (Thompson). 35. Monmouth : Langstone (Wade). 36. Hereford : Brinsop (Ridley). 37. Worcester : Shipston (Townsend). 39. Staffs : Alstonfield (Purchas). 40. Shropshire : Bridgnorth (Painter). 41. Glamorgan : Rhigos (Wade). 42. Brecon : Llangong (Ridley). Penywilt—v. *collina* (Barton). 43. Radnor : Erwood (Barton). 44. Carmarthen : Pembrey (Riddelsdell). 45. Pembroke : Caldy—v. *calcarea* ! 46. Cardigan : Mynach—v. *collina* (Fox). 47. Montgomery : Craig Breidden (Melvill). 48. Merioneth : Dolgelly (Vice). 49. Carnarvon : Gt. Orme—v. *transiens* ! Llanberis (Armitage). 50. Denbigh : Trevor—v. *calcarea* (Bailey). 51. Flint : Rhydynnynn (Dallman). 52. Anglesea : Holyhead (Riddelsdell). 54. N. Lincoln: Brigg (Bailey). 55. Leicester : S. Croxton (Horwood). 57. Derby : Via Gellia (Bailey). 58. Cheshire : Newbridge (Bailey). 59. S. Lancs : Southport (Bailey). 60. W. Lancs : St. Ann's (Bailey). 62. N.E. Yorks : Cleves (Baker). 63. S.W. Yorks : Saddleworth (Hannan). 64. M.W. Yorks : Clapham (Bailey). 69. N. Lancs : Mouzell (Pearsall). 70. Cumberland : Borrowdale—v. *collina* ! 71. I. Man : Patrick (Lewis). 73. Kirkcudbright : Portling (Bailey). 90. Forfar : Barrie—v. *sabulicola* ! 97. Westerness : Morar—v. *sabulicola* (Townsend). 100. Clyde Is. : Rothsay (Marshall). 101. Cantire : Achnamara (Salmon). 106. E. Ross : Tain—v. *transiens*, f. *procumbens* (Marshall). 109. Caithness : Bower !

General Distribution. Northern and eastern France, Belgium, Germany (except the north-east), Switzerland, Bohemia.

11. EUPHRASIA CONFUSA Pugsley in Journ. Bot. lvii, 169 (1919), lx, 1 (1922). *E. minima* Hiern in Journ. Bot. xlvii, 165 ; Bucknall, Brit. Euphr. 23, excl. var. *nana* (1917), non Jacquin nec aliorum. [Pl. **32**, figs. *a–c*.]

Icon. Journ. Bot. tab. 497 A (as *E. minima*).

Exsicc. Marshall, Nos. 4440 and 4443, as *E. minima* ; Wilmott, No. 830, as *E.* ——.

Plant relatively small, *stem ascending or decumbent, slender*, 2–20 (usually under 10) cm. high, greenish, clothed with fine, deflexed, crisped, white hairs, *with cauline leaves* generally *longer than the internodes*, which are never very long and sometimes, especially the lowest, extremely short ; *floral leaves alternate, usually about as long* (occasionally shorter) *as the moderate internodes* ; flowering from about the 7th pair of leaves ; normally much branched below, even from the cotyledons, *with numerous, long, slender, flexuous branches*, which are frequently again branched ; lowest branches often filiform. *Leaves small*, or very small, narrow, the largest (upper cauline) up to 7 mm. long, very numerous, green, with well-marked nerves below, not spreading, lower often caducous ; cauline oblong to oblong-obovate, obtuse, with 1–3 obtuse (rarely subacute) and often distant teeth on each side, cuneate below ; floral shorter or not, oval or elliptical, subacute or cuspidate, with 3–5 subacute or more rarely shortly aristate teeth ; leaves of branches mostly oblong ; all *nearly glabrous* with minute marginal bristles, rarely with a few very short glandular hairs. Calyx clothed like the foliage, with finely acuminate teeth, scarcely accrescent in fruit. *Corolla small*, dorsally 4·5–6 mm. long, more or less deeply *yellow*, *or* more often (f. *albida* Pugsl.) *white or purplish* with a yellow spot on the lower lip, always with ± strongly marked purplish lines; upper lip with porrect or reflexed, subentire or retuse lobes; *lower lip exceeding the upper*, with three emarginate lobes, the median longest. *Capsule* rather small, 4·5–5·5 mm. long, *oblong-elliptic*, *emarginate* or retuse, slightly pilose above as well as ciliate, generally exceeding the calyx-teeth.

β. atroviolacea, var. nov. [Pl. 32, fig. *d*.]
E. atroviolacea Druce & Lumb in Report Bot. Ex. Club, B.I. vii, 1, 49 (1924).
Exsicc. Johnston, Nos. 3485, 3486, as *E. atroviolacea.*

Dwarf and more compact than the type, only 2–4 cm. high, but similarly branched with flexuous branches. Leaves crowded, pale green, variable in hair-clothing, sometimes nearly glabrous, sometimes hirsute with ± numerous long, white hairs, occasionally very sparingly glandular; upper floral broader than in the type. Calyx somewhat accrescent in fruit. Corolla about 7 mm. long, pale or deep violet, with longer lobes to the upper lip than in the type, and a proportionately longer lower lip.

E. confusa is most closely related to *E. nemorosa* and *E. Pseudo-Kerneri*, but differs from both in its essentially decumbent, slender, and flexuous habit. Its almost regularly alternate floral leaves are also characteristic. It differs further from *E. nemorosa* by its narrower foliage with fewer teeth, and also by its more elliptical capsules; and *E. Pseudo-Kerneri* is separable at a glance by its very much larger corolla. *E. micrantha*, although bearing similarly small and narrow leaves, is widely different from *E. confusa* owing to its strict habit and relatively high branching; and its narrow capsules are quite distinct. It has already been demonstrated that *E. minima* Jacq. is an entirely different species of æstival habit belonging to the Series *Latifoliæ*.

The figure in Journ. Bot. cited above was drawn from weak examples that do not show the normally intricate branching.

The variety *atroviolacea*, though rather difficult to assess owing to its condensed habit, as so frequently happens with other coast-forms from the North of Scotland, is fortunately well represented in Col. Johnston's exsiccata, and seems clearly to possess the peculiar flexuous, branched habit and narrow foliage which are the special features of *E. confusa*.

The type-specimens of *E. minima* var. *arbuscula* from Patterdale in Herb. Bucknall are small examples of *E. confusa* f. *albida*.

The Eyebright described as *E. variabilis* in Report Bot. Exch. Club, B.I., for 1923, p. 50 (G. C. Druce, Glen, Peebles, 1918), is a mixture, some examples being apparently *E. confusa* f. *albida*, and others, with glandular foliage or larger flowers, probably a hybrid of this with some form of *E. brevipila*.

The form occuring in Orkney has rather large flowers and appears to hybridise with *E. borealis* and perhaps other species.

This species, which generally grows on grassy cliffs and moorlands on siliceous soils, is at present known only for Great Britain and the island of Sark. It occurs in the following vice-counties :—

2. E. Cornwall : St. Cleer (Rilstone). 4. N. Devon : Brayford (Wilmott). 5. W. Somerset : Grt. Cornham (Hiern). Simonsbath ! Withypool (Marshall). 49. Carnarvon : Llanberis ! Nant Francon ! 69. Westmoreland : Patterdale (Bucknall). 70. Cumberland : Derwentwater (Pearsall). 111. Orkney : N. Ronaldshay (Johnston, No. 904). Mainland (Johnston, No. 2014). Birsay—v. *atroviolacea* (Johnston). 112. Shetland : Exnaboe—v. *atroviolacea* (Hb. Manchester).

12. EUPHRASIA PSEUDO-KERNERI Pugsley in Journ. Bot. lxvii, 224 (1929). *E. Kerneri* Bucknall, Brit. Euphr. 25 (1917), et auct. angl. passim ; non Wettstein in Engler & Prantl, Natur. Pflanzenfam. iv, 3 *b*, 101, et Mon. Gattung Euphrasia, 201, nec *E. speciosa* A. Kerner, nec *E. arguta* A. Kerner. *E. officinalis* a. *Rostkoviana* f. *macilenta* Townsend in London Cat. Brit. Pl. ed. 9 (1895) (nomen). [Pl. 32, figs. *e, f.*]

Icon. Journ. Bot. tab. 375 (ut *E. Kerneri*).

Exsicc. Pugsley, Nos. 434, 447, and 448 (typus) ; Salmon, Reigate Hill, 1896, and Betchworth Hill, 1896, in Hb. Mus. Brit., ut *E Kerneri* ; A. Bennett, Chelsham, 1880, in Hb. Mus. Brit., ut *E. Kerneri.*

Caulis erectus, *robustus*, 5–25 (vulgo 10–15) cm. altus, purpurascens, pilis parvis deflexis crispulis albidis vestitus, *internodis omnibus brevibus* (sæpe quam foliis brevioribus) infimis nonnunquam brevissimis ; e foliorum pare 10^{0}–15^{0} florens ; *ramis adscendentibus plus minusve numerosis* dense ramosus, interdum iterum ramosus. *Folia parva* (maxima (caulina superiora) ad 8 (raro 10) mm. longa), crassa, numerosa, saturate viridia vel purpureo-tincta, inferne sæpe pallidiora, caulina patentia et floralia subregulariter arcuato-recurvata, infima facile caduca ; caulina inferiora oblongo-cuneata, utrinque 1–2 dentibus obtusis obtusa, superiora ovalia vel anguste ovata, 3–4 (raro 5) dentibus acutiusculis vel acuminatis obtusa vel acuta ; floralia ovata, acuta vel cuspidata, 3–5 (raro 6) dentibus acuminatis vel aristatis ; omnia *glabra* aut in margine setis minutis obsita. Calyx glaber vel setis minutis ciliatus, nervis sæpissime purpureo-tinctis et dentibus acuminatis præditus, fructifer haud accretus. *Corolla magna*, dorso 8–10 mm. longa, tubo calycis dentes tandem superante, *alba* vel labio superiore cærulescente vel lilacino, rarius omnino cæruleo- vel lilacino-tincta, striis violaceis picta et in labio inferiore læte luteo-maculata ; labio superiore elongato tubum subequante, lobis emarginatis reflexis prædito ; *labio inferiore multo longiore* deflexo, lobis latis patentibus valde emarginatis (medio longissimo) trilobato. *Capsula* parva, circa 5 mm. longa, *oblonga, truncata* vel paulo retusa, ciliata et superne subpilosa, vulgo quam calycis dentes brevior, folio subtendente sæpe longior.

Stem erect, *robust*, 5–25 (commonly 10–15) cm. high, purplish, ± densely clothed with fine, deflexed, crisped, white hairs, *with short internodes throughout* (frequently shorter than the leaves), the lowest sometimes very short; flowering from the 10th to the 15th pair of leaves; compactly branched *with ± numerous, ascending branches*, some of which are sometimes again branched. *Leaves small* (the largest—upper cauline—up to 8 (rarely 10) mm. long), thick, numerous, dark or purplish green, with the underside often paler, the cauline generally spreading and the floral ± regularly arcuate-recurved, lower readily caducous; lower cauline leaves cuneate-oblong, obtuse with 1–2 obtuse teeth on each side; upper cauline oval or narrowly ovate, obtuse or acute, with 3–4 (rarely 5) subacute or acuminate teeth; floral ovate, acute or cuspidate, with 3–5 (rarely 6) acuminate or aristate teeth; all *glabrous* or with minute marginal bristles. Calyx glabrous, or ciliate with minute bristles, usually with dark-coloured veins and acuminate teeth, not accrescent in fruit. *Corolla large*, dorsally 8–10 mm. long, with tube finally exceeding the calyx-teeth, *white* or with bluish upper lip, with a deep yellow spot on the lower lip and strongly marked dark purple lines, rarely wholly blue- or lilac-tinted; upper lip elongate, about as long as the tube, with reflexed, emarginate lobes; *lower lip much longer*, deflexed, with three broad, spreading, deeply emarginate lobes, the median longest. *Capsule* small, about 5 mm. long, *oblong*, *truncate* or slightly retuse, slightly pilose above as well as ciliate, usually shorter than the calyx-teeth but often exceeding the subtending leaf.

form. nov. *elongata*.

Exsicc. F. Robinson, No. 227, ut *E. gracilis*.

Habitu laxo, caule ad 40 cm. alto, internodis (floralibus summis exceptis) folia valde superantibus.

Of lax habit, with stem up to 40 cm. high and internodes, except the upper floral, far longer than the leaves.

E. Pseudo-Kerneri, in its typical form, is a beautiful plant of dwarf, robust and bushy habit, with small, dark foliage and large, bright flowers. The only British species with which it is likely to be confused is *E. nemorosa*, some forms of which, especially var. *calcarea*, sometimes found in the same localities, and var. *collina*, may assume a similar habit. But neither of these varieties produces the same large corolla, with elongate tube and upper lip, and their foliage is nearly always coarser.

E. Kerneri Wettst. (Mon. 201), with which this plant has been identified, is represented by authentic material both in Herb. Mus. Brit. and at Kew, and more copiously in Herb. Bailey at Manchester. It is evidently, as Wettstein remarks, allied to *E. Rostkoviana*, but is entirely eglandular and indeed almost glabrous. It differs from the British plant in its slender, flexuous habit, with more erect branches, and it frequently grows much larger (to 40 cm. high according to Wettstein). Its stem is not dark, but usually greenish, and its foliage is thinner and bright green in colour, as in *E. Rostkoviana*. The floral leaves are not small and arcuate-recurved as in *E. Pseudo-Kerneri*, but tend to increase in size towards the apex of the stem, and are suberect and rarely even spreading. They are invariably more or less cuneate based, too, and never ovate as in the British plant ; and their teeth are uniformly longer. The corolla is much larger, both longer and broader. It appreciably elongates during anthesis, and finally its tube conspicuously exceeds the calyx-teeth. Its dorsal length may reach 13 mm. In colour, judging from the material seen, it is whiter and less brightly marked than in *E. Pseudo-Kerneri*. The capsule is also different, being more oblong-elliptic and retuse, and thus nearer in form to that of *E. Rostkoviana*.

It is not easy to understand why the British plant should have been so identified. The geographical distribution of *E. Kerneri* (almost entirely Austria, Hungary, and Eastern Italy) makes its occurrence in Britain inherently improbable. Wettstein (Mon. 203), at the end of his detailed list of stations, gives "England. 'Chelsham near Croydon, Surrey' (Bennett, Hb. Towns.). Two examples of a species quite agreeing with *E. Kerneri*, which Townsend on the label showed as *E. macilenta*," adding "Its occurrence in England I cannot satisfactorily explain." This not very certain identification, based on two individual plants, was accepted as definite by Townsend, apparently without further question, and *E. Kerneri* was inserted in his Monograph the following year, as a British plant growing at Chelsham and a few additional stations. The Austrian and British plants do not seem to have been subsequently compared.

There is a specimen, consisting of two plants, now in Herb. Mus. Brit., labelled "A. Bennett, Chelsham, 1880," which may be that originally sent to Wettstein. The two plants are drawn up and very slightly branched individuals of *E. Pseudo-Kerneri*, altogether uncharacteristic, such as at a glance might have misled the monographer, who at that date could have had no prior knowledge of the British form. They well illustrate how misleading inadequate material can be in a critical genus like *Euphrasia*.

Townsend's account of *E. Kerneri* (Journ. Bot. xxxv, 469) has not been cited, as the description, synonymy, etc., as well as the remarks, are copied from Wettstein, and only the distribution in England refers to the British plant. Townsend's figure, however, is taken from *E. Pseudo-Kerneri*.

E. Pseudo-Kerneri has not been seen from any foreign station, but it might be expected to occur on the chalk-downs of Northern France. At present it must be regarded as an endemic British species. It is found almost exclusively on the chalk-downs of the South-East of England, where it is often abundant, and it is the latest of the genus to flower with us, rarely blooming before August and generally at its best in September. The form *elongata* has been collected in two or three damp spots in West Norfolk.

A rather large-flowered plant found at Matlock and elsewhere in Derbyshire has been identified with *E. Kerneri* by Townsend and later botanists, but of the material examined a part seems to be a large-flowered form of *E. nemorosa* var. *collina*, and part a doubtful form, possibly of hybrid origin. These forms need further investigation.

The known vice-counties for this species are :—

7. N. Wilts : Heddington (Barton). 10. Wight : Carisbrooke ! 11. S. Hants : Fareham (Notcutt). 13. W. Sussex : Arundel ! 14. E. Sussex : Saltdean (Hilton). 15. E. Kent : Folkestone (Bailey). 16. W. Kent : Cobham ! 17. Surrey : Box Hill, &c ! 20. Herts : Lilley Hoo (Little). 23. Oxford : Chinnor (Druce). 25. E. Suffolk : Kirkley (Trimen). 28. W. Norfolk : Foulden—f. *elongata* (Robinson). 29. Cambridge : Gogmagogs (Goode). 30. Beds : Totternhoe (Higgins).

SERIES III. BREVIPILÆ.

Plantæ robustæ haud humiles habitu speciebus æstivalibus plus minusve similes. Folia subglabra, puberulenta vel breviter (longius in *E. brevipilà* var. *notatâ* et *reayensi*) glandulosa. Corolla magna labio inferiore lato superius multo superante.

13. **EUPHRASIA BOREALIS** Townsend ex Wettstein, *l. c.* 108 and 298 (1896); Townsend, *l. c.* 400 (1897) ; Jørgensen, *l. c.* 227 (1919). *E. officinalis* a. *Rostkoviana* f. *borealis* Towns. in Lond. Cat. Brit. Pl. ed. 9 (1895) (nomen). [Pl. 33, fig. *a*.]

Icones. Jørgensen, *l. c.* tab. iv, tab. v, and tab. ix, ff. *a* & *b*.

Exsicc. Townsend, Borrowdale, 1884, and Braemar, 1890, in Hb. Towns. ; Beeby, No. 1170 ; Marshall, No. 4105.

Stem erect, *robust*, 10–35 cm. high, greenish or somewhat tinted with dull red, clothed with deflexed, crisped, whitish hairs of variable length, with *cauline leaves* (even the lowest) usually *much shorter than their long internodes*, but *floral leaves*, at least the upper, as long or *longer than their short internodes* ; generally flowering at about the 6th pair of leaves : *with few* or several long, *suberect branches* mostly from the upper flowerless nodes, and so, owing to the long internodes, at some distance from the base of the stem ; some branches in luxuriant individuals occasionally again branched. *Leaves large and broad* (up to 15 mm. long), cauline distant and not numerous, dark green, thick, ± spreading, not quickly caducous ; lower cauline oval, shortly cuneate below, rounded-obtuse with 1–3 obtuse teeth on each side ; upper cauline ovate, rounded below, very obtuse, with 3–5 obtuse (or the basal ± acute) teeth ; floral leaves nearly as large as the upper cauline, the lower broadly ovate, rounded-cordate below, obtuse, with 5–7 teeth (the upper ± obtuse, the lower narrower and acute), the upper more rhomboidal, ± cuneate below, with 4–6 deep, spreading, acute or acuminate teeth ; all *glabrous* or with minute marginal bristles, more rarely with some scattered hairs on the nerves beneath. Calyx glabrous, or with minute bristles on the teeth and nerves, with triangular-subulate teeth, strongly accrescent in fruit. *Corolla rather large*, dorsally 6–8 mm. long (occasionally longer in Orkney and Shetland), *white* or with bluish upper lip, or rarely wholly bluish, with yellow spot on the lower lip and well-marked dark lines ; upper lip broad, with porrect or reflexed, emarginate lobes ; *lower lip much longer*, trilobed with three broad, spreading, emarginate lobes, the median exceeding the lateral. *Capsule* large, 6–8 mm. long, *oblong, with broad rounded* or retuse *apex*, slightly pilose above as well as ciliate, subequalling the teeth of the accrescent calyx.

β. zetlandica, var. nov. [Pl. 33, fig. *b*.]

Exsicc. Beeby, Nos. 1133, 1173 ; Burdon, (1) Sumburgh Links, Dunrossness (typus in Hb. Pugsley), (2) Norvic, Unst, (3) Clibberswick, Shetland, 1921, ut *E.*——.

Planta quam typus minor, caule 5–20 cm. alto et internodis brevioribus. Foliorum floralium dentes acutiores. Corolla major, dorso 8–9 mm. longa, sæpe lilacina. Capsula calycis dentes breviores obtusioresque superans.

Smaller than the type, with stem 5–20 cm. high and shorter internodes. Teeth of floral leaves more acute. Corolla larger, 8–9 mm. long, often tinted with lilac. Capsule exceeding the shorter and less acute calyx-teeth.

γ. speciosa, var. nov. [Pl. 33, fig. *c*.]

E. borealis subsp. *atlantica* Jørgensen, *l. c.* 233 ?

Exsicc. Beeby, No. 1171 ; Burdon, Cunningsburgh, Mainland, Shetland, 1921, ut *E.* ——(typus in Hb. Pugsley).

Planta habitu laxo, caule 15–30 cm. alto, sæpe e foliorum pare quarto florens. Corolla maxima, dorso 8–10 mm. longa, tubo haud exserto, lilacina, purpureis striis picta et labio inferiore luteo-maculata ; labio superiore latissimo, quam tubo longiore ; labio inferiore lobis latissimis circa 9 mm. longo. Capsula maxima, oblongo-elliptica, emarginata, calycis dentibus longior, plane pedunculata.

Of lax habit, 15–30 cm. high, often flowering from the 4th pair of leaves. Corolla very large, dorsally 8–10 mm. long, with tube not exserted, lilac, with yellow spot on the lower lip and dark purple lines ; upper lip very broad, longer than the tube ; lower lip about 9 mm. long, with very broad lobes. Capsule very large, oblong-elliptic, emarginate, exceeding the calyx-teeth, distinctly pedunculate.

E. borealis is generally a distinct plant, readily separable from all the preceding species by its coarse growth and large foliage, combined with the lax habit and long, lower internodes characteristic of the early-summer species of the Series *Latifoliæ*. Its flowers are normally larger than in any species of the *Nemorosæ* except *E. Pseudo-Kerneri*, and in the variety *speciosa* they are remarkably fine and showy, almost equalling those of any species of the whole Section *Semicalcaratæ*. It is noteworthy that these flowers, though of the largest size, show no elongation of the corolla-tube.

Wettstein's original description of this species appears to have been taken chiefly from Townsend's specimens from Braemar, some of which are not characteristic, and it was amended in the Appendix after other material from the Faroes had been examined. The figure, drawn from a weak Braemar plant, has not been cited, for it is misleading and does not indicate the plant's normal habit. Townsend likewise figured a weak Braemar plant that is equally uncharacteristic. There is little doubt but that *E. borealis* was at first confused, both by Wettstein and Townsend, with *E. brevipila* and with large-flowered forms of *E. nemorosa*, and the Whichford and Long Compton exsiccata, which both of them cite, was subsequently referred to *E. nemorosa* by Townsend. A number of plants of *nemorosa*-like habit, but with broad floral leaves, have been named *E. borealis*. The most characteristic gathering cited in Wettstein's original description is Townsend's from Borrowdale, with which most of the later-named material in Herb. Townsend agrees. This form is here described as the typical species, and the early-summer habit of growth is regarded as an essential feature.

The variety *speciosa* agrees very closely with the descriptions and figures of Jørgensen's subspecies *atlantica*, but it is understood that the two plants are not considered identical by Jørgensen. It is also not unlike exsiccata sent out as *E. suecica* Murbeck & Wettstein.

E. borealis, which is generally an inhabitant of rough pastures, is widely distributed in Scotland, less so in England and Ireland. In the Orkneys and Shetlands it appears to be particularly abundant and variable.

The British vice-counties that have been noted are :—

11. S. Hants : Burton (Linton). 13. W. Sussex : Aldworth (Townsend). 33. E. Glo'ster : Crichley (Haines). 34. W. Glo'ster : Tiddenham (Riddelsdell). 41. Glamorgan : Llwydcoed (Riddelsdell). 42. Brecon : Hirwaun (Riddelsdell). 55. Leicester : Barsley (Horwood). 58. Cheshire : Mouldsworth (Bailey). 62. N.E. Yorks : Fylingdales ! 64. M.W. Yorks : Kettlewell ! 65. N.W. Yorks : Ribblehead ! 66. Durham : Teesdale (Hume). 69. Westmoreland : Patterdale (Bailey). 70. Cumberland : Borrowdale (Townsend). Keswick ! 92. S. Aberdeen : Braemar (Townsend). 93. N. Aberdeen : Slains (Trail). 97. Westerness : Inverailort (Townsend). 98. Argyll : Oban (Townsend). 100. Clyde Is. : Rothesay (Townsend). 103. Mid Ebudes : Tiree (Macvicar). 106. E. Ross : Strathpeffer (Bailey). 107. E. Sutherland : Brora (Marshall). 109. Caithness : Castletown ! 110. Outer Hebrides : N. Uist (Shoolbred). 111. Orkney : Mainland, with v. *zetlandica* and v. *speciosa* (Johnston). 112. Shetland, with vars. *zetlandica* and *speciosa* (Beeby). Foula (Gladstone).

General Distribution. Faroes. Norway, northwards to the Arctic Circle.

14. Euphrasia brevipila Burnat & Gremli, ex Gremli Excurs. Fl. Schweiz. ed. 5, 329 (1885) ; Townsend in Journ. Bot. xxii, 167 (1884), nomen solum ; Wettst. *l. c.* 109 (1896) ; Towns. in Journ. Bot. xxxv, 401 (1897) ; Chabert, *l. c.* 498 (1902) ; Jørgensen, *l. c.* 177 (1919). [Pl. **34**, figs. *a*, *b*.]

Icones. Wettst. *l. c.* tab. vii, f. 8 ; Journ. Bot. tab. 374 ; Jørgensen, *l. c.* tab. i, ff. *v–y*, tab. ii, ff. *b–f*, and tab. iii.

Exsicc. Burnat, Près Limone, Piémont, 1876, in Hb. Towns.; Favrat, Obergestlen, Haut-Valais, 1878, in Hb. Towns., as *E. majalis*; Fries, Hb. Norm. ix, 17, as *E. officinalis β. montana*; Dörfler, Hb. Norm. 3356; Fl. Ingric. No. 469, as *E. officinalis*; Marshall, Nos. 2082, 2083, and 2296; Salmon, Kinlochewe, 1896.

Stem erect, *robust*, 5–35 cm. high, usually tinted with dull red, ± densely clothed with deflexed, crisped, whitish hairs of variable length, some of which about the upper nodes are occasionally glandular, *with cauline and floral leaves*, except the highest and sometimes the lowest, *shorter* or much shorter *than their ± long internodes*; generally flowering from the 6th–8th pair of leaves; *with few* or several *long, suberect branches* from the upper flowerless nodes, which are generally distant from the base of the stem; branches rarely again branched. *Leaves large* (up to 18 mm. long), cauline generally distant, light or yellowish green, ± erect, lower often quickly caducous; lower cauline oblong, cuneate below, obtuse, with 1–3 obtuse teeth on each side; upper cauline oval or ovate, obtuse (rarely subacute) with 3–5 subacute teeth; floral leaves often as large as the upper cauline, ovate or broadly ovate, cuspidate or subacute, with 4–6 deep, acute or aristate teeth; uppermost leaves smaller and more cuneate-based; all *clothed* in varying degree *with ± shortly stalked glands and short bristles*, which may occur on both leaf-surfaces or be restricted to the margins or the base of the floral leaves, or glands occasionally obsolete (f. *subeglandulosa* Bucknall). Calyx ± clothed with short bristles and glandular hairs, with acuminate or aristate teeth, accrescent in fruit. *Corolla rather large*, dorsally 6–8 mm. long, normally *lilac* with purplish lines and a deep yellow spot on the lower lip, but sometimes paler, whitish with lilac or bluish upper lip; upper lip broad, with retuse or denticulate, reflexed or porrect lobes; *lower lip much longer*, decurved, trilobed with three broad, emarginate lobes, the median longest. *Capsule* large, 6–9 mm. long, *oblong with rounded and retuse apex*, sparingly pilose above as well as ciliate, equalling or exceeding the calyx-teeth.

form. nov. *gracilior*. [Pl. 34, fig. *c*.]

Exsicc. Marshall, No. 2064; Burdon, Jedburgh, 1921, ut *E.* —— (typus in Hb. Pugsley).

Humilior, caule gracili internodisque brevioribus. Folia angustiora (latissima sola ovata), dentibus acutioribus, floralium eis vulgo aristatis. Capsula minor, vix retusa.

Dwarfer, with slender stem and shorter internodes. Leaves narrower (only the broadest ovate), with acuter teeth, those of the floral leaves generally aristate. Capsule smaller and less retuse.

form. nov. *tenuiformis*. [Pl. 34, fig. *d*.]

Exsicc. Marshall, No. 1844.

Caulis simplex, raro ramosus, e foliorum pare sexto florens. Corolla major, circa 9 mm. longa. Capsula elliptico-oblonga, quam in typo latior.

Stem simple, rarely branched, flowering from the 6th pair of leaves. Corolla larger, about 9 mm. long. Capsule elliptic-oblong, broader than in the type.

β. notata, var. nov. [Pl. **35**, fig. *a*.]
× *E. notata* Townsend, *l. c.* 473 (1897).
Exsicc. Pugsley, Nos. 436 and 451 (typus); Gardiner, Ben Lawers, 1842, in Hb. Mus. Brit., ut *E. officinalis*.

Planta habitu robusto, haud humili. Folia quam typi paulo latiora, dentibus obtusioribus et pilis glanduliferis nonnunquam crispulis relative longis. Corolla magna, 8–9 mm. longa, alba præter labium superius lilacino- vel cæruleo-tinctum. Capsula elliptico-oblonga, quam in typo latior.

Robust in habit and fairly tall. Leaves rather broader than in the type, with more obtuse teeth and glandular hairs sometimes waved and relatively long. Corolla large, 8–9 mm. long, white, with the upper lip tinted with lilac or blue. Capsule elliptic-oblong, broader than in the type.

γ. reayensis, var. nov. [Pl. **35**, fig. *b*.]
E. Rostkoviana, forma—Townsend, *l. c.* 467 (1897).
Exsicc. Pugsley, No. 435 (typus): Linton, Reay, 1888, in Hb. Mus. Brit., ut *E. Rostkoviana*.

Planta robusta, caule 5–20 cm. alto, interdum satis ramoso, internodis relative brevibus foliisque magnis (floralibus superioribus sæpe imbricatis) prædita. Folia quam typi latiora, floralia sæpius triangulari-reniformia, inferne fere truncata, obtusa vel subacuta, utrinque 5–7 dentibus angustis acuminatis aristatisve prædita, omnia griseo-viridia pilis brevibus longisque glanduliferis eglanduliferisque dense vestita. Calycis dentes quam in typo latiores. Corolla circa 8 mm. longa, labio superiore lilacino vel cæruleo albida. Capsula typi.

Robust, with stem 5–20 cm. high, sometimes freely branched, with relatively short internodes and large leaves, the upper floral often imbricated. Leaves broader than in the type, floral generally triangular-reniform, nearly truncate below, obtuse or subacute, with 5–7 narrow, acuminate or aristate teeth on each side, all grey-green with dense long and short, glandular and eglandular hairs. Calyx-teeth broader than in the type. Corolla about 8 mm. long, whitish with lilac or blue upper lip. Capsule as in the type.

E. brevipila, when typical and well grown, is a distinct plant not easily to be mistaken. It has the same coarse and tall growth as *E. borealis*, with large foliage and flowers, but it differs in its rather narrower and more finely toothed leaves, which are lighter in colour and nearly always more or less glandular; and its flowers are lilac instead of white. On an average, its habit of growth approximates less closely to the early-summer type than that of *E. borealis*, and in many localities dwarf forms occur with shorter internodes and lower branching that tend towards the usual late-summer habit. The form *gracilior*, in its small and finely-cut foliage, resembles *E. curta* or *E. Pseudo-Kerneri*, and is not very different from Jørgensen's Norwegian variety *strictoides* (*l. c.* 183). This, however, is separable by its truly *stricta*-like leaves. The form *tenuiformis* is intermediate between typical *E. brevipila* and *E. tenuis*, which is a true early-summer species not known in Britain. Similar plants are frequent in Scandinavia.

The variety *notata* is a conspicuous feature in July of the slopes north of Loch Tay and elsewhere in Perthshire, and has often been identified with *E. Rostkoviana*. Specimens referred to Townsend were repeatedly determined by him as *E. brevipila* × *Rostkoviana*, and in the case of other similar material Wettstein is said to have agreed to this naming, provided the suggested parents were found in the neighbourhood. *E. brevipila* is common in Scotland and grows in the vicinity of this plant, but I have never seen a specimen of *E. Rostkoviana* from any station in the Scottish Highlands. It therefore seems difficult to regard this well-marked plant as the hybrid suggested, and better to associate it with *E. brevipila*, whose habit it possesses and with which it is certainly connected by intermediate forms. Its large, white flowers give it the general aspect of *E. Rostkoviana*, except that it lacks the slender, flexuous habit and the elongating corolla-tube, and Wettstein is reported to have favoured this identification as an alternative to hybridity for the specimens sent to him by Townsend. It is just possible, but unlikely, that this variety has arisen from crossing with a form of *E. hirtella* which grows at Lawers and also near Killin.

The second variety *reayensis* is a more puzzling form, which I found in abundance on Reay Links, Caithness, in 1927, just as Marshall and others had seen it there many years previously. But for the total absence of *E. Rostkoviana* in the North of Scotland, it might be suspected to be a form or hybrid of that species, under which it is treated by Townsend. It shows, however, the leaf-cutting and capsules of *E. brevipila*, and, on the whole, seems best placed under it in spite of its remarkable glandular development. It may eventually be found that it deserves separate specific rank.

As in some other cases, there is a little difficulty in determining the actual type of *E. brevipila*. The name was first printed by Townsend in 1884, and is so cited by Wettstein ; but it is a name only— and that simply as a variety—in a general enumeration of European forms. The earliest brief diagnosis of the plant as a species, *E. brevipila*, is by Gremli in 1885, and the first full description is Wettstein's. The specimen from which Townsend took the name is still in his herbarium. It was communicated by Burnat, in whose handwriting it is labelled "*E. brevipila* Burn. & Gremli ined. Prés Limone, Piémont, 12.7.76, leg. E. Burnat." The specimen appears to agree with another in Herb. Favrat, collected by Burnat in a neighbouring station in the Alpes-Maritimes, and seen and figured by Wettstein ; and it must seemingly be regarded as a co-type of the species. It is a large, slightly branched plant of lax habit, with large, lilac-coloured flowers, and forms in part the basis of the foregoing description of the species.

E. brevipila grows chiefly in meadows, pastures and hillsides, and also on grassy sea-cliffs. It is widely distributed in Scotland, but is more local in England and Wales. It has been recorded from a number of Irish stations.

The vice-counties in Great Britain from which it has been noted are :—

1. W. Cornwall : Lizard (Riddelsdell). 4. N. Devon : Ilfracombe (Catcheside). 6. N. Somerset : Blagdon ! 9. Dorset : Swanage ! Corfe (Marshall). 10. Wight : Ventnor (Townsend). 22. Berks : Newbury (A. B. Jackson). 23. Oxford : Wigginton (Riddelsdell). 33. E. Glo'ster : Snowshill (Riddelsdell). 34. W. Glo'ster : Cherrington (E. M. Day). 35. Monmouth : Henllys (Wade). 38. Warwick : Honington (Townsend). 39. Staffs : Holme End (Bailey). 41. Glamorgan : Pontneathvaughan (Riddelsdell). 43. Radnor : Nantgwyllt (Ley). 45. Pembroke : Crymmych Arms (Todd). 46. Cardigan : Aberayron (Painter). 48. Merioneth : Arthog (Barton). 49. Carnarvon : Llanfairfechan ! 55. Leicester : Alverscroft (A. B. Jackson). 61. S.E. Yorks : Bempton (Edwards). 62. N.E. Yorks : Thirsk (Baker). 70. Cumberland : Keswick (Reynolds). 72. Dumfries : Moffat (Marshall). 75. Ayr : Colmonell (Marshall). 80. Roxburgh : Jedburgh—f. *gracilior* (Burdon). 81. Berwick : Ayton (Bailey). 83. Edinburgh (Hooker). 87. W. Perth : Crianlarich—v. *notata* ! 88. Mid Perth : Lawers—with v. *notata* ! 90. Forfar : Clova—with f. *gracilior* ! 91. Kincardine : St. Cyrus ! 92. S. Aberdeen : Braemar ! 95. Elgin : Garmouth (Marshall). 96. Easterness : Kingussie (Marshall). 97. Westerness : Fort William ! Glen Roy ! 98. Argyll : Oban (Bailey). 99. Dumbarton : Milngavie (Turrill). 100. Clyde Is. : Arran (Marshall). 101. Cantire : Auchindarroch (Salmon). 105. W. Ross : Kinlochewe (Salmon). 106. E. Ross : Kincllan (Bailey). 107. E. Sutherland : Loch Shin (Salmon). 108. W. Sutherland : Tongue—with f. *tenuiformis* (Marshall). 109. Caithness : Scrabster ! Reay—v. *reayensis* ! 110. Outer Hebrides : N. Uist (Shoolbred). 111. Orkney : E. Ronaldshay (Johnston).

General Distribution. Maritime and Cottian Alps, Savoy, Southern and Eastern Switzerland (Valais, Ticino, Graubunden), Austria (from Tyrol to Galicia), West Prussia, Denmark, Scandinavia (widely distributed), Finland, Poland, and West Russia.

The prevalent form of Northern Europe closely matches the original material from the Maritime Alps, while specimens from Austria are often much smaller in all their parts.

A form apparently inseparable from this species is found in Newfoundland and Canada—possibly an introduction from Europe. This is represented in the exsiccata, Macoun, No. 1696 (Cape Breton), Fernald, No. 3989 (Newfoundland) and Fernald, No. 8026 (Magdalen Is., Quebec).

SERIES IV. HIRTELLÆ.

Plantæ habitu æstivali vel autumnali. Folia pilis longis crispulis multicellularibus glanduliferis plus minusve dense vestita. Corolla parva ad maxima, labio inferiore porrecto superius plane superante. Capsula lata, plus minusve emarginata.

15. **EUPHRASIA ROSTKOVIANA** Hayne, Arzneigewächse, Band 9, No. 7 (1825) : Wettstein, *l. c.* 183 (1896) ; Townsend, *l. c.* 467 (1897) ; Chabert, *l. c.* 146 (1902) ; Jørgensen, *l. c.* 266 (1919). *E. officinalis* L. Sp. Pl. 604 (1753), ex parte ; et auct. mult. *E. officinalis* A. *E. pratensis* Fries, Novit. Fl. Suec. ed. 2, 198 (1828).

Icones. Hayne, *l. c.* tab. 7 ; Wettst. *l. c.* tab. ix, f. 1, tab. xii, ff. 9–13 ; Coste, Fl. Fr. 2750, as *E. officinalis*.

Exsicc. Reichb. Exs. No. 244, as *E. pratensis* ; Billot, No. 62, as *E. officinalis* ; Rostan, Fl. Ped. No. 47, as *E. officinalis* ; Schultz, Hb. Norm. 1839 ; Hayek, Fl. Stiriaca, No. 143 ; Dörfler, Hb. Norm. 4576 ; Wilmott, No. 2455, Kerry.

Plant of late-summer habit. Stem suberect from a decumbent base, *slender and flexuous,* 10–40 cm. high, green or slightly reddish, ± densely clothed with crisped, deflexed or spreading, white, eglandular or in the upper part of the stem also glandular hairs of variable length, *with lower cauline leaves longer than the short internodes, and upper cauline and floral leaves* (except the uppermost) *generally shorter than their longer internodes* ; flowering from the 8th–12th pair of leaves ; *with* ± numerous *slender, flexuous branches from near the base of the stem,* occasionally again branched. *Leaves rather small* (up to 10 mm. long), numerous, bright green, rather thin, often with conspicuous nerves below, ± spreading, lower readily caducous ; lower cauline oblong, cuneate below, rounded-obtuse with 1–3 obtuse teeth on each side ; upper cauline oval to ovate, obtuse, with 3–6 obtuse to acute teeth ; floral leaves becoming smaller than the upper cauline, ovate or broadly ovate, shortly cuneate, rounded or truncate below, cuspidate or subacute, with 4–6 acute, acuminate or aristate teeth, uppermost narrower and more cuneate below with deeper teeth ; all *clothed ± densely* above and below *with long and shorter glandular hairs,* often intermingled with some eglandular bristles. Calyx clothed like the foliage, with long, finely acuminate teeth, scarcely accrescent in fruit. *Corolla* normally *very large,* dorsally 8–9 mm. long at first, and *elongating* during anthesis to 10–12 mm. (to 14 mm. ap. Wettstein and to 16 mm. ap. Chabert) *with tube much exceeding the calyx-teeth, white* with a deep yellow spot on the lower lip and dark purple lines, the upper lip often tinted with lilac ; upper lip with broad, emarginate, reflexed or porrect lobes ; *lower lip much longer* (to 10 mm. long), porrect and not deflexed, trilobed with three broad, spreading, deeply emarginate lobes, the median much the longest. *Capsule* of medium size or small, 4·5–6·5 mm. long, *elliptic* or oblong-elliptic, with rounded, *emarginate* or retuse apex, sparingly pilose above as well as ciliate, equalling or shorter than the calyx-teeth.

β. obscura, var. nov. [Pl. 35, figs. *c, d.*]

Exsicc. Barton, No. 155 B (typus) ; Ingham, Warthill, 1908, in Hb. Mus. Brit.

Planta sæpius minus ramosa. Corolla quam typi minor, 6–8 mm., fine anthesis 7–9 mm. longa.

Plant generally less branched. Corolla smaller than in the type, 6–8 mm. long, elongating to 7–9 mm.

This species was described by Hayne from specimens received from Stettin and was stated to grow all over Germany. It is represented by abundant, homogeneous material in Herb. Mus. Brit. and Herb. Kew, which agrees with the descriptions and figures of Hayne and of Wettstein, and permits no doubt as to its identity.

The above description has been drawn up from Continental exsiccata, and it is not certain that the typical species exists in Britain. *E. Rostkoviana* is a very well marked and uniform plant in Central Europe, distinguished from *E. brevipila* and other species by its low, ascending habit, bright green, glandular foliage, very large, white flowers with a conspicuous yellow blotch and exserted tube, and small, broad capsules. It is a very characteristic feature of Swiss mountain meadows in late summer. Löhr, contrasting it with *E. stricta* and *E. nemorosa* in his 'Flora of Coblentz,' calls it "the lesser Eyebright," for it never assumes the erect, bushy habit of these and some other species.

Specimens collected in the south-west of Ireland by Marshall, and more recently by Mr. Wilmott, appear to agree with the typical form of *E. Rostkoviana*, as described above, except that their corollas are somewhat smaller. These plants may be regarded as falling under the type. Material from North Yorkshire, collected by Ingham and others, as well as Welsh examples, which are clearly referable to this species from their habit and general characters, produce still smaller flowers, with a corolla-tube showing little, if any, elongation. These have been separated as a variety, *obscura*. The common English glandular Eyebright, generally named *E. Rostkoviana* by British botanists, differs from these plants in several essential features and is now described as a new species. The very large-flowered, glandular form of the Lake District is identified with *E. montana* Jord. No form of *E. Rostkoviana* has been seen from Scotland.

British glandular Eyebrights appear to have been first referred to *E. Rostkoviana* by Townsend, and the name appears as a variety of *E. officinalis* in the 9th edition of the 'London Catalogue of British Plants' (1895). In Wettstein's Monograph two English and two Scottish records are given for this species, all of which are inaccurate. The Buxton plant is that referred to under *E. occidentalis*; the Rosthwaite form *E. montana*; and both of the Scottish plants belong to the variable *E. brevipila*. In all of these cases Wettstein probably saw only inadequate material. Townsend, in his Monograph, did not distinguish *E. Rostkoviana* from *E. montana*, although in 1884 he had likened the British plant to the last-named (Journ. Bot. xxii, 163), and the former is represented by the latter in his plate (Journ. Bot. tab. 377). Furthermore, with these he placed the common English glandular Eyebright with non-elongating corolla-tube, which does not seem to have been referred to Wettstein.

E. Rostkoviana, which flowers in July and August, is an inhabitant of moist meadows and grasslands, and is rare and local in England and Wales. It is unknown in Scotland. In Ireland it is probably more widely spread, and has been seen from the counties Sligo, Westmeath, Galway, Cork, and Kerry.

It has been noted from the following vice-counties of Great Britain (all var. *obscura*) :—

34. W. Glo'ster: Woodchester (Riddelsdell). 35. Monmouth: Troy House (Riddelsdell). 41. Glamorgan: Aberdare (Riddelsdell). 42. Brecon: Llanwrtyd (Painter). 46. Cardigan: Devil's Bridge (Marquand). 48. Merioneth: Barmouth! 49. Carnarvon: Llanberis! 60. W. Lancs: Hindburndale (Wilson). 62. N.E. Yorks: Warthill (Ingham). 65. N.W. Yorks: Sedbergh (Ingham). 69. Westmoreland: Rydal (Ridley). 70. Cumberland: Rowrah (Burton).

General Distribution. Germany. Austria. Switzerland. North Italy. Poland. Scandinavia (rare). Denmark (rare). France (often untypical).

16. EUPHRASIA MONTANA Jordan, Pugillus 132 (1852): Wettstein, *l. c.* 194 (1896). *E. Rostkoviana montana* Chabert, *l. c.* 150 (1902) ; *E. Rostkoviana* subsp. *montana* Jørgensen, *l. c.* 272 (1919). [Pl. **36**, figs. *a*, *b*.]

Icones. Wettst. *l. c.* tab. ix, ff. 2–4 ; Journ. Bot. tab. 377, as *E. Rostkoviana.*

Exsicc. Billot, No. 2723 ; Wirtgen, No. 703 *a*, as *E. pratensis* var. *obtusifolia præcox* : Soc. Dauph. No. 4990 ; Dörfler, Hb. Norm. 3362 ; Baker, High Force, Durham, 1865, as *E. officinalis.*

Plant of early-summer habit. Stem erect, generally *rather slender,* 5–35 cm. high, green or slightly reddish, ± densely clothed with crisped, deflexed or spreading, white, eglandular (or rarely glandular in the upper part of the stem) hairs of variable length, with cauline and floral *leaves* (except the uppermost) *much shorter than the very long internodes* ; flowering from the 3rd–6th pair of leaves ; *unbranched* or with 1–5 slender branches from the upper cauline leaves. *Leaves of moderate size* (up to 14 mm. long, but rarely exceeding 10 mm.), few and distant below, bright green, rather thin, ± spreading, not readily caducous ; lower cauline oblong or elliptic, ± cuneate below, rounded-obtuse with 1–3 rounded-obtuse teeth on each side ; upper cauline ovate or rotund-ovate, rounded below, with 3–5 (rarely 6) very obtuse teeth ; floral leaves, at least the lower, as large as the cauline, subrotund or ovate-triangular, rounded or subtruncate below, obtuse or more rarely acute, with 4–6 obtuse, acute, or rarely acuminate teeth, uppermost narrower, more deeply and acutely toothed ; all ± densely *clothed* above and below *with short and long glandular hairs,* with some eglandular bristles at least on the margins. Calyx clothed like the foliage, usually very glandular, with long, triangular-subulate teeth, slightly accrescent in fruit. *Corolla very large,* dorsally 8–10 mm. long, elongating during anthesis to 10–13 mm. (–14 mm. ap. Wettst.) with tube much exceeding the calyx-teeth, *white* with yellow spot on the lower lip and dark purple lines, the upper lip often lilac ; upper lip with broad, retuse or denticulate, reflexed or porrect lobes ; *lower lip much longer* (to 10 mm. long), porrect, trilobed with three broad, spreading, emarginate lobes, the median much the longest. *Capsule* of medium size, 5·5–6·5 mm. long, *elliptic*, with broad, rounded, *retuse* or enarginate apex, sparingly pilose above as well as ciliate, equalling or shorter than the calyx-teeth.

E. montana differs from *E. Rostkoviana*, with which, in Wettstein's view, it has a common origin, by its markedly æstival instead of autumnal habit, and it flowers fully a month earlier. It is commonly unbranched, with distant leaves distinctly broader and more obtusely cut than those of *E. Rostkoviana*. In the Alps its foliage generally shows fewer and shorter glandular hairs, but this does not seem to be so in Scandinavia, in France, or indeed in Britain. It is usually a coarser plant than its late-flowering ally, not only in its foliage but in its broader calyx-teeth and its capsules.

The species was originally described by Jordan (*l. c.*) from plants growing on Mont Vivarais and Mont Pilat, south of Lyons, and there is a specimen from the latter station in Herb. Mus. Brit. (Billot, No. 2723). A specimen in Herb. Kew from Crummock Water, Cumberland, was labelled "*E. montana* Jord." by the late C. B. Clarke.

E. montana, which, like *E. Rostkoviana*, is a plant of meadows and grasslands, chiefly in mountainous regions, is at present known only from the Lake District and Yorkshire, in England. It also occurs in Wales, where it seems to produce abnormally small flowers. No examples have been seen from Scotland or Ireland.

The British vice-counties from which it has been noted are :—

42. Brecon : Llangamarch (Riddelsdell). 64. M.W. Yorks : Grassington ! 65. N.W. Yorks : Ribblehead ! 66. Durham : Teesdale (Baker). 69. Westmoreland : Shap (Bailey). Grisedale ! 70. Cumberland : Rosthwaite (Townsend).

General Distribution. France. Switzerland. North Italy. Austria. South Germany. Sweden (rare). Belgium (rare).

17. EUPHRASIA RIVULARIS Pugsley in Journ. Bot. lxvii, 225 (1929). [Pl. **36**, figs. *c*, *d*.]

Exsicc. Pugsley, No. 438.

Planta habitu æstivali. Caulis erectus, gracillimus, 5–15 cm. altus, plus minusve purpurascens, pilis parvis deflexis crispulis albidis eglanduliferis dense vestitus, *foliis caulinis floralibusque* (summis exceptis) *quam internodis* qui ad medium caulem longissimi sunt, *brevioribus*, præditus ; e foliorum pare 4°–6° florens ; *haud ramosus* vel e foliis caulinis superioribus 1–5 ramos graciles emittens. *Folia minima* (ad 7 mm. longa, vulgo multo breviora), haud numerosa, saturate viridia vel purpureo-tincta, erecto-patentia, haud facile caduca ; caulina inferiora ovalia, inferne plus minusve cuneata, apice lato rotundato-obtuso et utrinque 1–2 dentibus obtusis ; superiora late ovalia ad ovata, inferne rotundata, 2–3 dentibus obtusis rotundato-obtusa ; floralia late ovata, 3–4 (raro 5) dentibus plus minusve acutis subacuta, summa dentibus longioribus

angustiora ; omnia *pilis glanduliferis* longis brevibusque (sæpe parce) *vestita* atque in marginibus et nonnunquam in paginâ superiore setis minutis obsita. Calyx nunc glandulifer, nunc setis minutis solis obsitus, dentibus triangulari-subulatis paululum brevibus, fructifer haud accretus. *Corolla magna,* dorso 8–9 mm. longa, tubo calycis dentes tandem superante, præter labium superius saturate lilacinum *albida lilacino-tincta,* striis purpureis valde picta et in labio inferiore luteo-maculata ; labii superioris lobis retusis, porrectis vel reflexis ; *labio inferiore longiore* porrecto lobis (quorum medius longissimus) patentibus latis retusis trilobato. *Capsula* parva, circa 5 mm. longa, *elliptica,* apice rotundato *retusa,* superne paulo pilosa et ciliata, calycis dentibus subæquilonga.

Plant of early summer habit. Stem erect, very slender, 5–15 cm. high, ± purplish, densely clothed with fine, deflexed, crisped, whitish, eglandular hairs, with *cauline and floral leaves* (except the uppermost) *shorter than the internodes,* which are longest about the middle of the stem ; flowering from the 4th–6th pair of leaves ; *unbranched* or with 1–5 slender branches from the upper cauline leaves. *Leaves very small* (up to 7 mm. long, but usually much shorter), few, dark green or purple-tinted, erect-spreading, not readily caducous ; lower cauline oval, ± cuneate below, with broad, rounded-obtuse apex and 1–2 obtuse teeth on each side ; upper cauline broadly oval to ovate, rounded below, with rounded-obtuse apex and 2–3 obtuse teeth ; floral leaves broadly ovate, subacute, with 3–4 (rarely 5) ± acute teeth, uppermost narrower with longer teeth ; all *clothed,* but often sparingly, *with* long and short *glandular hairs,* and with short bristles on the margins and sometimes the upper surface. Calyx sometimes glandular, sometimes with short bristles only, with rather short triangular-subulate teeth, not accrescent in fruit. *Corolla large,* dorsally 8–9 mm. long, with tube finally exceeding the calyx-teeth, *white tinted with lilac,* with yellow spot on the lower lip and strongly marked purple lines, upper lip purplish lilac ; upper lip with retuse, porrect or reflexed lobes ; *lower lip longer,* porrect, trilobed with three broad, spreading, retuse lobes, the median exceeding the lateral. *Capsule* small, about 5 mm. long, *elliptic,* with rounded, *retuse* apex, sparingly pilose above as well as ciliate, subequalling the calyx-teeth.

form. nov. *compacta.* [Pl. 36, figs. *e*, *f*.]

Exsicc. Pugsley, No. 439.

Minima, caule ·5–2 cm. alto haud ramoso, internodis subobsoletis et foliis quam in typo interdum angustioribus.

Very dwarf, with stem ·5–2 cm. high, unbranched, with obsolescent internodes and leaves sometimes narrower than in the type.

E. rivularis clearly belongs to the Series *Hirtellæ* owing to its glandular foliage and broad capsules. It differs from the two preceding species by its very small size, dark stem and foliage, less glandular development, and smaller, lilac rather than white corolla. When well grown it is an elegant and beautiful little plant, with its dark, wiry stem, neat foliage and relatively showy flowers.

The variety *minuta* Beck (Fl. Nieder-Œsterreich, 1059 (1893)) and other dwarf, alpine forms of *E. Rostkoviana* are coarser plants than *E. rivularis* with bright green (sometimes black-edged) leaves and white flowers.

This diminutive plant has hitherto been overlooked. I first found the form *compacta* in 1917, growing on bare slopes near Clogwyn dur Arddu, on Snowdon. In 1922 it was growing in this locality in some abundance. In 1925 I met with the typical form on the steep, grassy slopes of the Glydyr range above Nant Francon, where it was quite uniform and scattered over a considerable area. When looked for, it will probably be found to be widely distributed on the Snowdonian mountains like the other dwarf species, *E. cambrica.* The only examples of *E. rivalaris* seen in herbaria are (1) part of a mixed gathering by Wheldon labelled "Near Llanberis, Merioneth (*sic*), 1919," and now in the collection of the University of Wales, and (2) a form from Cader Idris (Coll. W. A. Vice, 1905), whose identity is not quite certain.

18. EUPHRASIA ANGLICA Pugsley in Journ. Bot. lxvii, 225 (1929). *E. Rostkoviana* Bucknall, Brit. Euphr. 26 (1917) et auct. angl. passim; non Hayne nec Wettstein nec aliorum. [Pl. **36**, fig. *g*: Pl. **37**, fig. *a*.]

Icones. Curtis, Fl. Londin. 335, ut *E. officinalis*: Eng. Bot. 1416, ut *E. officinalis.*

Exsicc. Pugsley, No. 440 (typus); Marshall, Nos. 1826, 2267, 4429, 4433, ut *E. Rostkoviana.*

Planta habitu autumnali. Caulis e basi decumbente *adscendens, flexuosus sed vix gracilis,* 10–40 cm. altus, plus minusve purpurascens, inferne pilis deflexis crispulis albidis eglanduliferis, superne pilis longioribus magis patentibus sæpe glanduliferis dense vestitus, *foliis caulinis quam internodis brevibus normaliter longioribus, floralibus internodos* sæpius *subæquantibus* nonnunquam brevioribus vel (præsertim summis) longioribus præditus; vulgo e foliorum parc sexto florens; *ramos longos flexuosos* paucos vel multos caulis basin versus *gerens,* vel rarius simplex, interdum iterum ramosus. *Folia majuscula* (ad 10 mm. longa), lata, numerosa, griseo-viridia, crassiuscula, patentia, infima facile caduca; caulina inferiora oblonga ad ovata, utrinque 1–3 dentibus obtusis complanatis rotundato-obtusa; superiora ovata, 3–4 dentibus obtusis rotundato-obtusa; floralia vulgo subopposita, caulinis superioribus æquilonga, late vel triangulari-ovata, inferne rotundata vel subtruncata, 4–5 (raro 6) dentibus latis plus minusve acutis sæpe complanatis obtusa vel acuta, summa inferne magis cuneata et profundius dentata; omnia *pilis glanduliferis longis brevibusque* setis brevibus immixtis (saltem in marginibus) plus minusve præsertim in paginâ inferiore dense *vestita.* Calyx pilis glanduliferis vestitus, dentibus triangulari-subulatis, fructifer vix accretus. *Corolla magna,* dorso 7–9 mm. longa, tubo nec extendente nec calycis dentes multo superante, præter labium superius lilacinum *albida vel lilacino-tincta,* striis purpureis picta et in labio inferiore luteo-maculata; labii superioris lobis latis, emarginatis, reflexis vel porrectis; *labio inferiore longiore,* porrecto, lobis (quorum medius longissimus) latis, emarginatis trilobato. *Capsula* mediocris, 5–7 mm. longa, *elliptica* vel late elliptica, *apice* rotundato, *emarginato* vel retuso vel raro subtruncato, superne ciliata et parce pilosa, calycis dentibus sæpissime subæquilonga.

Plant of late-summer habit. Stem ascending from a decumbent base, *flexuous but rather robust,* 10–40 cm. high, ± purple-tinted, densely clothed below with crisped, deflexed, white, eglandular hairs, and above with longer, more spreading hairs which are often glandular, with *cauline leaves normally longer than their short internodes* and *floral leaves* often *subequalling their internodes,* but sometimes shorter or longer (especially the uppermost) ; flowering from the 6th pair of leaves ; *with* few or many *long, flexuous branches* from near the base of the stem or occasionally unbranched, sometimes with secondary branches. *Leaves of moderate size* (up to 10 mm. long), broad, numerous, greyish-green, rather thick, spreading, lower readily caducous ; lower cauline oblong to oval, rounded-obtuse with 1–3 obtuse, flattened teeth on each side ; upper cauline ovate, rounded-obtuse with 3–4 obtuse teeth ; floral leaves generally subopposite, at least as large as the upper cauline, broadly ovate or ovate-triangular, rounded or subtruncate below, obtuse or acute, with 4–5 (rarely 6) broad, ± acute, generally shallow teeth, uppermost more cuneate below and more deeply toothed ; all ± densely *clothed,* especially below, *with long and shorter, glandular hairs,* intermingled with some short bristles, chiefly on the margins. Calyx clothed with glandular hairs, with triangular-subulate teeth, scarcely accrescent in fruit. *Corolla large,* dorsally 7–9 mm. long, with tube not elongating or much exceeding the calyx-teeth, *whitish or tinted with lilac,* with a yellow spot on the lower lip and dark purple lines, the upper lip ± lilac : upper lip with broad, emarginate, reflexed or porrect lobes ; *lower lip longer,* porrect, trilobed with three broad, emarginate lobes, the median longest. *Capsule* of moderate size, 5–7 mm. long, *elliptic* or broadly elliptic, with rounded and *emarginate,* retuse, or rarely subtruncate *apex,* sparingly pilose above as well as ciliate, generally subequalling the calyx-teeth.

β. gracilescens, var. nov. [Pl. 37, figs. *b, c.*]

Exsicc. Barton, No. 277, ut *E. fennica.*

Planta nana, caule 5–15 cm. alto, gracili, fere erecto, simplici vel 1–3 ramos breves emittente, e foliorum pare septimo florens. Folia parva (ad 7 mm. longa). Corolla circa 7 mm. longa. Capsula parva, circa 5 mm. longa, apice latissimo valde emarginato. Aliter ut in typo.

Plant dwarf, with stem 5–15 cm. high, slender, nearly erect, simple or with 1–3 short, flexuous branches, flowering from the 7th pair of leaves. Leaves small (up to 7 mm. long). Corolla about 7 mm. long. Capsule small, about 5 mm. long, with very broad, deeply emarginate apex. Otherwise like the type.

E. anglica, which is a widely spread plant throughout England and relatively uniform, seems to be best treated as a distinct species coming between *E. Rostkoviana* and *E. hirtella.* From the former of these, of which it possesses the flexuous, ascending habit in a still more marked degree, it differs in foliage, in flowers and in fruit. The leaves of *E. anglica* are thicker, broader, and more coarsely toothed than those of *E. Rostkoviana*, and of a dull greyish instead of a bright green colour. In *E. Rostkoviana* the largest leaves are normally the highest cauline and the floral become quickly smaller ; in *E. anglica* the lowest floral leaves commonly exceed all of the cauline and do not decrease in size as growth proceeds and the stem elongates. *E. anglica* commences to flower at an earlier node than *E. Rostkoviana* and usually continues to bloom over a long period, often forming elongated spikes with closely-set floral leaves. The corolla of the two species, on the opening of the flower, shows little difference in dorsal length, but that of *E. Rostkoviana* is actually much the larger owing to the greater development of its lower lip. During anthesis its tube elongates to the extent of 2–3 mm., while in *E. anglica* the lengthening is inappreciable, and so finally it is a much more exserted as well as a larger flower. Its colour is whiter than in *E. anglica*, with a larger and deeper yellow blotch. The capsule of *E. anglica* is broader, more distinctly elliptic, and rather larger than that of *E. Rostkoviana*, and enclosed in a more coarsely toothed fruiting calyx.

E. hirtella resembles *E. anglica* in that its broad, subopposite floral leaves are larger than the cauline, and it often develops a long leafy spike. But it is erect in growth, and either unbranched or nearly so, approximating to the early-summer habit and flowering from about the fourth pair of leaves. It is a still more conspicuously glandular plant and normally has distinctly smaller flowers.

Of the two remaining British species of the group *E. montana* is readily separable from *E. anglica* by its erect, early-summer habit and distant leaves, with flowers of the largest size. The same habit, combined with dwarf, slender growth and very small, dark foliage distinguishes *E. rivularis*.

The variety *gracilescens*, found in North Devon, differs considerably from typical *E. anglica*, but is connected by a series of intermediate forms. It is much slenderer and more erect in habit, thus approaching *E. rivularis*, from which it may be separated by its more leafy stem, producing flowers from a higher node, its more glandular foliage, smaller corolla, and very broad and deeply emarginate capsules.

There is a remarkable plant in Herb. Mus. Brit. (Standen, Piltdown Common, Sussex, 1902) which strongly resembles *E. campestris* Jord. It is of similar slender habit, with numerous small, narrow, densely glandular leaves, and large, exserted corollas, 9 mm. long. But it differs from *E. campestris* in beginning to flower from about the 10th instead of the 15th node, and it is less strict with more spreading branches and the floral leaves more or less alternate. It is probably of hybrid origin between *E. anglica* and *E. Pseudo-Kerneri*.

E. anglica is a plant of moist and heavy soils, also of peaty heathlands. It begins to flower during June and usually continues till the end of September. It is at present certainly known only for Britain and is found chiefly in England. It apparently does not grow in Scotland, but occurs in Ireland (*e.g.* Wicklow and Galway). There is a French specimen in Herb. Gadeceau, now in Herb.

Mus. Brit. (Vieillevigne, Dep. Loire Inf.), that may also belong here, but it is undesirable to record it from a single example in view of the divergencies of form that *E. Rostkoviana* assumes in France.

E. anglica has been noted for the following vice-counties in Great Britain, viz :—

1. W. Cornwall : Penzance (Curnow). 2. E. Cornwall : Polperro (Rilstone). 3. S. Devon : Dartmoor (Hume). 4. N. Devon : Lynmouth—v. *gracilescens* ! 5. W. Somerset : Simonsbath—with v. *gracilescens* (Marshall). 6. N. Somerset : Rowberrow (Bucknall). 7. N. Wilts : Savernake (A. B. Jackson). 10. Wight : Freshwater (Bailey). 11. S. Hants : Brockenhurst (Murray). 13. W. Sussex : Lurgashall (Townsend). 14. E. Sussex : Ashdown Forest (Hilton). 16. W. Kent : Tunbridge Wells (Hume). 17. Surrey : Wimbledon ! Box Hill ! 18. S. Essex : Little Warley (Littlebury). 21. Middlesex : Pinner (C. B. Green). 22. Berks : Windsor (Cox). 27. E. Norfolk : Scanning (Robinson). 28. W. Norfolk : Gooderstone (Robinson). 35. Monmouth : Bigsweir (Shoolbred). 36. Hereford : Ross (Ley). 40. Salop : Albrighton (Lloyd). 41. Glamorgan : St. Donat's (Riddelsdell). 42. Brecon : Craig Fan-ddu (Wade). 46. Cardigan : Llanbadarn (Marquand). 48. Merioneth : Arthog (Barton). 55. Leicester : Ulverscroft (Bell). 71. I. Man : Laxey (Ridley).

19. EUPHRASIA HIRTELLA Jordan ex Reuter in Comptes-rendus de la Société Hallérienne, iv, 120 (1854–56) ; Wettstein, *l. c.* 175 (1896) ; Chabert, *l. c.* 143 (1902) ; Pugsley in Journ. Bot. lvii, 173 (1919).

Icones. Wettst. *l. c.* tab. viii, ff. 4, 5, & 7 ; Coste, Fl. France, 2751.

Exsicc. Jordan, Lautaret, 1864, in Hb. Mus. Brit. ; Billot, No. 2333 ter ; Rostan, Fl. Ped. No. 46.

Plant of ± *early-summer habit. Stem erect,* strict, *robust,* 5–30 cm. high, greenish or tinted with purple, densely clothed with crisped, deflexed, white, eglandular hairs, intermingled above with longer, more spreading glandular hairs, *with cauline leaves* generally much *shorter than their long internodes,* and *floral leaves* (except the lowest) *exceeding their short internodes* and often crowded in a dense spike ; flowering from the 4th–6th pair of leaves ; *simple* or occasionally with 1–4 short, suberect branches. *Leaves rather large* (up to 14 mm. long), subopposite, occasionally petiolulate, rather numerous, greyish-green or sometimes reddish-tinted, often paler beneath, plicate below when dry, suberect, not readily caducous ; cauline leaves oblong or obvate to broadly ovate, rounded below except the lowest, rounded-obtuse with 1–6 obtuse or subacute teeth on each side ; floral leaves generally exceeding the upper cauline, broadly ovate to rotundate-triangular, rounded or subcordate below, but uppermost becoming cuneate, obtuse to acute, with 4–8 acute or accuminate teeth, generally imbricated and covering the fruiting calyces ; all *densely clothed,* especially beneath, *with long and shorter glandular,* often shining, *hairs,* with short bristles, at least on the margins. Calyx clothed with glandular hairs, often pale or whitish green with darker nerves, with short, subulate teeth, slightly accrescent in fruit. *Corolla* normally *small*, dorsally 5–7 mm. long, tube not exceeding calyx-teeth, *white* with bluish-tinted upper lip, a yellow spot on the lower lip and strongly marked purple lines ; upper lip with short, denticulate or retuse, porrect or spreading lobes ; *lower lip longer*, trilobed with three narrow, retuse or emarginate lobes, the median longest. *Capsule* of moderate size, 5–6·5 mm. long, *oblong-ovate*, *retuse* or emarginate, subpilose above as well as ciliate, equalling or slightly exceeding the calyx-teeth.

β. polyadena, comb. nov.

E. polyadena Grenier & Roux in Gren. Fl. Jurass. 566 (1869) ; *E. hirtella polyadena* Chabert, *l. c.* 145 ; *E. tatarica* race *E. hirtella* var. *polyadena* Rouy, Fl. Fr. xi, 149 (1909). [Pl. **37**, figs. *d*, *e*.]

Exsicc. Billot, No. 2332 bis ; Sennen, Pl. d'Espagne, No. 1753 ; Pugsley, Nos. 441 and 450.

Dwarfer and slenderer than the type, with stem 5–20 cm. high and spike sometimes interrupted ; lower internodes shorter, and upper often longer, with floral leaves more distant and rarely imbricated; flowering from the 5th–8th pair of leaves. Leaves smaller (to 8 mm. long), narrower and less obtusely toothed : the cauline mostly oblong or oblong-lanceolate, with 3–4 subacute teeth, and the floral ovate, acute, with 4–5 acute or acuminate teeth. Corolla 5–8 mm. long. Capsule 5–6 mm.long, often equalling or exceeding its subtending leaf.

This species differs from the other British members of the Group *Hirtellae* chiefly in its erect, unbranched leafy habit. It is a very widely spread plant and varies considerably in its foliage. In the Alps it is generally seen with long lower internodes and a dense spike of imbricated, broad and rather obtusely cut floral leaves. But occasionally the lower internodes are quite short, as in examples that I collected at Arolla in 1906. The cutting of the floral leaves also shows great variations, and in Jordan's own specimens cited above their teeth are deep and almost acuminate.

The form occurring in Britain is less like typical *E. hirtella* than *E. polyadena*, as defined by Chabert. The original plant of Grenier and Roux came from wet fields at Berre, in Provence, and is identified with the form found in the Pyrenees by Chabert, who cites the Billot exsiccata shown above, which is Pyrenean. Billot's plant agrees with other Pyrenean material in herbaria, and differs from the Alpine or typical form of *E. hirtella* in having shorter lower internodes, narrower and rather more acutely cut leaves, less crowded above, and sometimes larger flowers. These differences are alluded to by Wettstein (*l. c.* 179). The British plants are nearly uniform in their short internodes below, and resemble the Pyrenean form, but they vary much in the stem and the breadth of the floral leaves. In my original Llanberis gathering (No. 441) the stem is robust and the floral leaves broad, but in other British specimens since examined the stem is weak and slender with much narrower leaves. This is especially marked in Mr. Salmon's Scottish examples and in other material that I have recently collected near

Killin, which, moreover, have larger flowers than the Welsh plant or than Jordan's type. It may be doubted, however, whether the differences between the Welsh and Scottish plants are of much real importance, and it seems best to refer tham all to one variety, *polyadena*, of *E. hirtella* Jord. The similarity of the British and Pyrenean forms of this plant is noteworthy.

E. hirtella var. *polyadena* is a plant of mountain pastures in North Wales, where it sometimes, as near Barmouth, grows in company with *E. Rostkoviana* var. *obscura*, with which it appears to hybridise. It is also known from two Scottish stations in Perthshire.

The recorded vice-counties are :—

46. Cardigan : Llanbadarn (Marquand). 48. Merioneth : Barmouth ! Bryn Glas (Lewis). 49. Carnarvon : Llanberis ! Snowdon and Glydyrs (Miss Armitage). 88. Mid Perth : Lawers (Salmon). Killin !

General Distribution. The species *E. hirtella* is one of the most widely spread of the genus, ranging from Spain across Central Europe to North-Eastern Asia. The variety *polyadena* is known, outside Great Britain, only from the original station at Berre and a few other similar localities in Provence, and from the Hautes-Pyrénées and Pyrénées-Orientales, where it seems to be of more frequent occurrence.

SUBSECTION II. ANGUSTIFOLIÆ Jørgensen Euphr. Norweg. 61 (1919) ; Wettstein, *l. c.* 69 (as series).

20. EUPHRASIA SALISBURGENSIS Funck in Hoppe, Bot. Taschenbuch, 190 (1794) ; Wettstein, *l. c.* 218 (1896) ; Townsend in Journ. Bot. xxxiv, 441 (1896) and xxxv, 471 (1897) ; Chabert, *l. c.* 509 (1902) ; Jørgensen, *l. c.* 70 (1919).

Icones. Boccone, Mus. Piant. tab., 60 f. BB ; Wettst. *l. c.* tab. x, ff. 6–10 ; Coste, Fl. France, 2753 ; Jørgensen, *l. c.* tab. 1, ff. *a–g*.

Exsicc. Reichb. Exs. No. 48 ; Schultz, Hb. Norm. 932 ; Rostan, Fl. Ped. No. 50 ; Kerner, Fl. Exs. Austro-Hungarica, No. 144.

Plant of early- or late-summer habit. Stem erect, usually *slender,* 2–25 cm. high, greenish or tinted with red or purple, clothed with fine, crisped, deflexed, white, eglandular hairs, with lower cauline leaves generally exceeding the short internodes, and the *upper cauline and floral shorter or longer than the variable,* but rarely very long *internodes* ; flowering from the 4th–16th pair of leaves ; *usually much branched* (with suberect branches, sometimes again branched) or more rarely simple. *Leaves of moderate size* (up to 10 mm. long), *narrow,* floral mostly alternate, numerous, green or tinted with brown or purple, suberect (spreading in var. *cuprea*), not readily caducous ; lower cauline linear-oblong, attenuate below, obtuse with 1 obtuse tooth on each side ; *upper cauline linear, oblanceolate or narrowly oblong,* attenuate or cuneate below, acute or obtuse, with 1–4 distant, obtuse, acute or aristate teeth ; floral at least as large as the cauline, linear, lanceolate or rhomboidal, cuneate below, acute to finely acuminate, with 2–5 distant, spreading, acute to long-aristate teeth; all *glabrous* or with minute bristles on margins and nerves of the underside. Calyx glabrous, with long, finely pointed teeth, somewhat accrescent in fruit. *Corolla small*, dorsally 5–7 mm. long, normally *white* with a yellow spot on the lower lip and faintly marked purple lines, but sometimes more or less blue, violet or purple; upper lip with small, subentire, reflexed or porrect lobes; *lower lip longer*, trilobed with three retuse lobes, the median longest. *Capsule* of moderate size, 4–6 mm. long, *oblong* or linear-oblong, *truncate* or retuse, *glabrous* or very rarely subciliate with a few weak bristles, usually shorter than the calyx-teeth.

β. hibernica, var. nov. [Pl. 37, figs. *f*, *g*.]

Icones. Journ. Bot. tab. 363 and 376.

Exsicc. Marshall, No. 1607; Praeger, Co. Clare, 1905, in Hb. Mus. Brit.; Waddell, Ballynort, 1908, in Hb. Mus. Brit. (typus).

Caulis 2–10 cm. altus, gracilis, ramis numerosis patentibus foliisque parvis internodos breviusculos sæpius subæquantibus præditus. Folia caulina vulgo lineari-oblonga obtusa, floralia lanceolata acuminata. Corolla alba. Capsula plane retusa.

Stem 2–10 cm. high, slender, with numerous, spreading branches and small leaves generally equalling the rather short internodes. Cauline leaves mostly linear-oblong, obtuse; floral lanceolate, acuminate. Corolla white. Capsule distinctly retuse.

E. salisburgensis is at once distinguishable from all the other British species by the form of its narrow and distantly toothed leaves and by the absence of stiff marginal hairs from its capsules. It was originally described by Funck from Salzburg, and is represented from that locality by Reichb. Exs. No. 48 and other exsiccata. These specimens are of late-summer habit, often much branched with very narrow leaves, and white flowers. The species, however, as understood by Wettstein, is polymorphic, and a number of varieties have been distinguished, some of which are widely different from the Salzburg plant. Some forms are of early-summer habit, and in Scandinavia the plant is usually unbranched. The Irish form appears from the material examined to present uniformly some peculiar features. It is of low but slender growth, with rather spreading branches, and can be separated from Continental specimens by this character. Its capsules also are somewhat broader than in the type and more distinctly retuse. As these characters seem constant and different from those of any described foreign form, the Irish plant is distinguished as a new variety, *hibernica*. The figure accompanying Townsend's paper of 1896 depicts a shade-grown example with abnormally broad leaves.

E. salisburgensis seems to have been first discovered in Ireland in 1856 by A. G. More (Colgan in Journ. Bot. xxxv, 196), but it was not until 1896 that it was dealt with under that name by Townsend. It is now known for a number of stations in the counties of Mayo, Galway, Clare, Leitrim, Fermanagh, and Limerick, and is apparently confined to limestone districts, growing usually in stony pastures. It also occurs on limestone in the North of England, for there are specimens in Herb. Mus. Brit. which exactly match the Irish form collected by the late F. Arnold Lees at Outershaw, N.W. Yorks, and Buckden, M.W. Yorks., in 1885 and 1886. These were at first referred by the collector to *E. gracilis* and subsequently corrected, but the interesting discovery of the species in Great Britain does not seem to have hitherto been published. The plant is not known for Wales or Scotland.

There is a remarkable plant in Herb. Townsend, collected by Praeger at Lough Goura, King's County, in 1898, with pilose but eglandular foliage, which has been referred to *E. salisburgensis* × *brevipila.*

General Distribution. Austria. Switzerland. Germany. Scandinavia. Balkan Peninsula. Italy. France (south and east, including Pyrenees and Corsica). Spain (Sierra Nevada).

HYBRID FORMS.

In addition to the foregoing species, with their varieties and forms, there exists in Britain a large number of more or less intermediate plants. It has already been pointed out that in this section of the genus hybrids are to a great extent fortile ; and in many localities colonies of particular forms, which come up year after year, are frequently found in the neighbourhood of different species, with all the appearance of being derived from crosses berween them. In other localities intermediate forms grow regularly where the species which they appear to connect are not to be found, but it is often discovered upon investigation that these species are growing at no great distance. Several hybrids of this nature are described by Wettstein, and others by Townsend ; and Jørgensen also mentions their occurrence in a number of cases in Scandinavia. The following seem to reproduce themselves in Britain as more or less stable forms.

E. MICRANTHA × SCOTICA.

× *E. electa* Townsend, *l. c.* 474 (1897).

Exsicc. Townsend, Loch Maree, 1897, in Hb. Towns. ; Riddelsdell, Aultguish, 1902, in Hb. Barton.

Differs from *E. micrantha* in its laxer habit, with larger, greener, floral leaves, and by its emarginate capsules ; from *E. scotica* by its purplish corolla, with the lower lip distinctly exceeding the upper one.

This was reported by Townsend as growing by Loch Maree, Rossshire, with both parents, and his specimens, although variable, appear to be correctly determined. Mr. Riddelsdell's examples from the same county seem to be the same hybrid, which is probably of frequent occurrence as the two species often grow in close proximity in Scotland. A somewhat different plant, much branched, with very small, deep purple corollas of *scotica*-form, occurs on Ben Vrackie. In the herbarium the hybrid may not always be distinguished easily from *E. scotica*, var. *purpurascens.*

E. MICRANTHA × BREVIPILA.

× *E. difformis* Townsend, *l. c.* 473 (1897) ; Bucknall, *l. c.* 15 (1917).

Exsicc. Townsend, Shiel Bridge, 1896, in Hb. Towns. ; White, Roundstone, Galway, 1907, in Hb. Bailey.

The plant described by Townsend recalls a rather dwarf *E. brevipila* in habit and foliage, but its leaves are eglandular and nearly glabrous, and the flowers small and blue, resembling those of *E. micrantha.* The Irish form is a tall, scarcely branched plant, 20–30 cm. high, with cauline leaves much like those of *E. micrantha,* and floral ones with aristate teeth as in *E. brevipila,* many of the leaves bearing more or less numerous, short glandular hairs ; and the corolla blue and rather large. The two parent species were seen in the vicinity of this form.

E. MICRANTHA × ANGLICA.

E. Vigursii F. H. Davey in Journ. Bot. xlv 217 (1907), pro parte.

Exsicc. Davey, Goonhavern, 1906, in Hb. Mus. Brit. ; Vigurs, Roborough, Yelverton, 1906, in Hb. Mus. Brit.

Of slender habit, erect, with suberect branches from the highest of the numerous cauline leaves, as in *E. micrantha.* Leaves small, recalling those of *E. micrantha,* the floral often larger and broader, and approaching those of *E, anglica* ; all clothed more or less densely with glandular hairs of variable length ; occasionally obtuse with blunter teeth. Corolla rather large, dorsally 6–8 mm. long, pale or deep violet, with a yellow spot on the lower lip and dark purple lines ; upper lip with emarginate, reflexed or porrect lobes ; lower lip distinctly longer, with three broad, emarginate lobes, the median longest. Capsule, when developed, 5–6 mm. long, oblong-elliptic, emarginate, exceeding the calyx-teeth.

The original specimens, as described above, resemble *E. micrantha* in their habit and small foliage, and in the colour of the corolla ; in the larger floral leaves, and their glandular clothing, as well as in the size of the corolla and the shape of the capsule, they recall *E. anglica.*

It is noteworthy that in nearly if not quite every locality that produces *E. Vigursii,* both *E. anglica* and violet-flowered *E. micrantha* occur, and the form of the hybrid is by no means uniform. Many specimens are barren to a great extent, and this misled Davey to describe the capsule as shorter than the calyx-teeth. Recent gatherings at Roborough Downs consist mainly of plants that are nearly pure violet-flowered *E. anglica,* and other later exsiccata (*e. g.* Rilstone, Perranporth, 1918) show a transition to the very beautiful large-leaved form collected by Mr. Little at Kittow's Moor in 1924 (No. 599, as *E. Rostkoviana*), which is probably of the same hybrid parentage. It may be doubted how far the violet colour prevalent in these plants is due to *micrantha*-parentage and how far to the influence of the soil.

It seems clear from Davey's account of this plant (*l. c.* 218) that Wettstein did not authorise its publication as a new species. Wettstein remarked that he should probably consider it a form of *E. Rostkoviana*, but that if it proved to be widespread and to take in its distribution the place of *E. Rostkoviana*, its description as a species would be as admissible as that of *E. campestris* Jord. The widespread plant that takes the place of *E. Rostkoviana* in England is *E. anglica*, with which Wettstein was not acquainted.

E. micrantha × *anglica* occurs in its most distinct form on moorlands near Newquay, Cornwall, also in varying states on Dartmoor, and as a different, more luxuriant plant in North Cornwall.

The variety *pallens* Bucknall (*l. c.* 16) is not a form of *E. Vigursii* but a mixture of *E. brevipila* and *E. curta*, according to the original specimens in his herbarium.

E. SCOTICA × BREVIPILA.

× *E. venusta* Townsend, *l. c.* 474 (1897).

Exsicc. Townsend, Poolewe, 1897, in Hb. Towns. and Hb. Bailey; Trail, Scotston Moor, 1900, in Hb. Towns.

The Poolewe hybrid is intermediate between the parents, rather tall and lax in habit, with shortly glandular foliage smaller than that of *E. brevipila*, flowers of moderate size, and well-developed capsules longer than the calyx-teeth. Townsend states that it grew with *E. scotica* and *E. brevipila*. The Scotston moor plant seems to differ only in its smaller foliage.

E. CURTA × NEMOROSA.

Exsicc. Pugsley, No. 413, ut *E. curta* var. *glabrescens*.

Planta valde ramosa quam *E. curta* robustior; folia floralia lata dentibus crassioribus et minus acutis prædita, nonnunquam fere glabra, sæpius superne et in marginibus setulis brevibus atque in paginâ inferiore pilis longioribus sparsis vestita. Calyx vulgo ut in *E. curtâ* hirsutus sed dentibus latis haud tenuiter acuminatis. Capsula 5-6·5 mm. longa, oblonga, retusa, calycis dentes æquans vel paulo superans.

Much branched and more robust than *E. curta*; floral leaves broad with coarser and less acute teeth, sometimes nearly glabrous, oftener with short hairs on the margins and upper surface, and scattered, longer hairs below. Calyx generally hirsute as in *E. curta*, but with coarse and not finely pointed teeth. Capsule 5–6·5 mm. long, oblong, retuse, equalling or slightly exceeding the calyx-teeth.

This plant, intermediate between *E. curta* and *E. nemorosa*, is found at Criccieth, at Nevin, and at other places on the coast of Carnarvonshire. So far as is known, it does not now grow in this county actually in company with the reputed parents, although both of them occur in its vicinity. The hybrid is also to be met with on the Lancashire sandhills, where it appears sometimes to grow intermingled with the two parent species. This hybrid is only known as occurring between coast-forms of *E. curta* and *E. nemorosa*,

E. CURTA × BREVIPILA.

× *E. Murbeckii* Wettstein, *l. c.* 288 (1896).

Exsicc. Townsend, Morar Bay, 1897, in Hb. Towns.; Trail, Cruden, 1900, in Hb. Towns.; Marshall, No. 1840, Tongue, 1897.

This hybrid generally shows the larger foliage of *E. brevipila*, clothed with the pilose hairs of *E. curta*, and eglandular; sometimes the leaves are scarcely distinguishable from those of *E. curta*. The corolla is usually lilac-tinted as in *E. brevipila* and larger than in *E. curta*. Townsend's Morar Bay specimens, at first thought to be *E. occidentalis* × *brevipila* (× *E. pratiuscula* Towns.), are all dwarf plants, variable in the clothing of the foliage and the size and colour of the flowers. The plants collected by Trail and Marshall are taller forms of more *brevipila*-like habit, with the foliage-hairs of *E. curta* and rather large flowers.

In Scandinavia, where both parent species are abundant, this hybrid appears to be frequent, and it is often easily recognized in sheets of exsiccata.

E. NEMOROSA × CONFUSA.

Exsicc. Pugsley, No. 443, Lynmouth, 1920; Barton, No. 266; Little, No. 607, Davidstone, 1924.

Planta quam *E. nemorosa* gracilior, magis flexuosa, quam *E. confusa* robustior erectiorque. *E. confusæ* folia, sed floralia latiora, magis ovata, utrinque 4–6 dentibus prædita. Corolla sæpe majuscula, dorso 7 mm. longa, sæpissime plus minusve cærulea vel lilacino-tincta, labio inferiore magno patente nonnunquam grosse luteo-maculato. Capsula quam in *E. confusa* angustior.

Slenderer and more flexuous than *E. nemorosa*, coarser and more erect than *E. confusa*. Leaves of the latter, but the floral broader, more ovate, with 4–6 teeth. Corolla often rather large, dorsally 7 mm. long, with large, spreading lower lip, generally more or less blue-or lilac-tinted, sometimes with an enlarged yellow spot on the lower lip. Capsule narrower than in *E. confusa*.

This plant is morphologically intermediate between *E. nemorosa* and *E. confusa*, and is generally easily recognized by its elegant growth and brightly coloured flowers. It is found in many stations from West Somerset to Penzance; and both on Exmoor and in North Cornwall it grows in the neighbourhood of *E. confusa*. It is common round Lynmouth, and specimens from this habitat were referred to *E. Kerneri* by Townsend. It is likely that this hybrid may be found wherever the two parents grow in proximity, and its occurrence over a wider area westward may indicate a former extension of the range of *E. confusa*.

E. NEMOROSA var. CALCAREA × PSEUDO-KERNERI.

Exsicc. Pugsley, No. 442 A, Box Hill, 1920.

Planta habitu quam *E. nemorosæ* var. *calcareæ* graciliore, foliis minoribus, floralibus minus dentatis magis arcuato-recurvatis. Calycis dentes ut in *E. nemorosa* latiusculi. Corolla magnitudinis intermediæ labio superiore *E. Pseudo-Kerneri* longo prædita.

Plant of slenderer habit than *E. nemorosa* var. *calcarea*, with smaller leaves, the floral with fewer teeth and more arcuate-recurved. Calyx-teeth rather coarse as in *E. nemorosa.* Corolla intermediate in size, with the long upper lip of *E. Pseudo-Kerneri.*

This hybrid is of common occurrence in the chalk districts of Surrey and probably in all places where *E. nemorosa* var. *calcarea* and *E. Pseudo-Kerneri* grow together. It is rarely a uniform plant, and apparently crosses and recrosses freely with either parent, so that almost every kind of intermediate can sometimes be found in a single district.

E. NEMOROSA × BREVIPILA.

E. campestris var. *neglecta* Bucknall, *l. c.* 19 (1917), pro parte.

Exsicc. Townsend, Buxton, 1884, ut *E. campestris*; Bucknall, Failand and Cadbury Camp, 1916, ut E. *campestris* ; Pugsley, Nos. 444 and 444 A (Shanklin).

Planta hybrida valde variabilis, sæpissime foliis minoribus internodisque brevioribus quam in *E. brevipilá*, et floribus majusculis. Caulis nunc ut in *E. nemorosá* typicâ altus multo ramosus, nunc parum ramosus, nunc nanus gracilis *E. Pseudo-Kerneri* simulans. Folia sæpius pilis glanduliferis brevibus plus minusve vestita, interdum glabrescentia et eglandulosa, atque, quod ad formam pertinet, *E. nemorosæ* eis similia sed floralia nonnunquam majora latiora. Corolla majuscula, dorso 6–8 mm. longa, alba vel rarius cæruleo- vel lilacino-tincta. Capsula nunc calycis dentes superans nunc brevior.

A very variable hybrid, usually with smaller leaves and shorter internodes than *E. brevipila,* and rather large flowers. Stem sometimes tall and much branched as in typical *E. nemorosa,* sometimes but little branched, sometimes dwarf, slender and resembling *E. Pseudo-Kerneri.* Leaves generally more or less clothed with shortly stalked glands, but sometimes glabrescent and eglandular, in form resembling those of *E. nemorosa,* but with the floral sometimes larger and broader. Corolla dorsally 6–8 mm. long, white or more rarely blue- or lavender-tinted. Capsule sometimes exceeding the calyx-teeth, sometimes shorter.

The above description is intended to cover a number of forms, occurring in different parts of Britain, which in varying degree are intermediate between *E. nemorosa* and *E. brevipila,* and are probably the result of hybridisation. Most of these plants produce the foliar glands characteristic of *E. brevipila* and have sometimes been referred to that species, but almost invariably the influence of *E. nemorosa* is clearly seen in their habit and foliage.

The plant described by Bucknall (*l. c.*) as *E. campestris* var. *neglecta* was afterwards admitted to be inseparable from *E. nemorosa* except for its glandular foliage, and Bucknall's specimens from Failand and Cadbury Camp have the aspect of well-grown, typical *E. nemorosa* with fairly numerous shortly-stalked glands on the foliage and calyx, and the corollas rather larger than usual. Other examples similarly named by Bucknall from North Devon, Gloucestershire, and Glamorgan are either identical or show by their laxer habit more of the influence of *E. brevipila.*

A more difficult form is the Derbyshire *E. campestris* or *E. Kerneri.* Townsend, in his Monograph (p. 469), introduced a plant from Buxton which he thought resembled *E. campestris* Jord., and which Wettstein after suggesting *E. brevipila*, subsequently considered doubtful. Townsend also (*l.c.* 470) cited Matlock among the localities for his *E. Kerneri.* In Townsend's herbarium the Derbyshire specimens of *E. campestris* and *E. Kerneri* are alike except for the foliar glands, and I can find no other difference in more recent and better material. Among specimens sent to me as *E. campestris* are some that are eglandular, and a portion of those received as *E. Kerneri* are glandular. It thus appears that there is one plant in Derbyshire that may be glandular or not, which has been referred sometimes to *E. campestris*, sometimes to *E. Kerneri.* This plant is in no way related to *E. campestris* Jord., which is densely glandular and allied to *E. Rostkoviana*, but some of the specimens are very like *E. Pseudo-Kerneri.* They seem to be usually of dwarf and slender growth, and morphologically just what might be expected from a cross with *E. brevipila.* But as I have seen no undoubted example of *E. Pseudo-Kerneri*—a relatively local plant—from Derbyshire or the North of England, I conclude that the second parent must be a form of *E. nemorosa*, and that the peculiar habit must result from local conditions. One specimen of this form in Herb. Townsend has been determined as *E. stricta* × *Rostkoviana.* Similar forms also grow in the limestone districts of Yorkshire and require further investigation.

Other slightly differing forms are found in the South of England. Glandular specimens from Swanage and Corfe Castle, named *E. brevipila* by Townsend, possess the habit and foliage of *E. nemorosa* and are almost certainly crosses, both parents being known in the neighbourhood. At Steephill, Isle of Wight, a similar glandular form occurs, and on Shanklin Downs an almost eglandular form, with the laxer habit and coloured flowers of *E. brevipila*, is abundant. In these cases, or at least some of them, it is possible that the second parent may be *E. Pseudo-Kerneri* instead of *E. nemorosa.*

E. NEMOROSA × ANGLICA ?

× *E. glanduligera* Wettstein, *l. c.* 290 (1896); *E. nemorosa* × *Rostkoviana* Towns. *l. c.* 473 (1897).

This plant was found by Townsend near Buxton, Derbyshire, growing with both parents. There is a specimen in Herb. Bailey, which agrees with the description, showing a slightly branched plant of flexuous growth, with broad, obtusely cut and slightly glandular foliage, corollas of moderate size, and broad capsules. It appears probable from the foliage that *E. anglica*, which Townsend did not distinguish, is one of the parents rather than *E. Rostkoviana.*

The sheet of this plant in Herb. Townsend contains a set of specimens that does not agree with that in Herb. Bailey. They are dwarf, much branched examples, with dense foliage, sometimes very shortly glandular, and small flowers; and they closely resemble typical *E. occidentalis.* A transposition of specimens or labels has possibly taken place.

In Bucknall's 'British Euphrasiæ,' p. 29, mention is made of another presumed hybrid, which it is stated that Townsend had named *E. curta* × *Rostkoviana* (× *E. Levieri* Wettst.). Bucknall does not agree with this name, and suggests *E. Kerneri* × *Rostkoviana* (× *E. Rechingeri* Wettst.). I possess a good sheet of this plant collected by Bucknall in 1916, and the leaves show rather numerous simple hairs— a feature which probably induced Townsend to regard *E. curta* as a parent species. But the specimens are doubtfully of hybrid origin in my opinion, and seem to be excessively branched, abnormal examples of *E. anglica*. I have seen similar plants growing among more normal ones in damp, mossy ground in Surrey and elsewhere; and specimens obtained by Townsend near Haslemere and now in his herbarium are not very different.

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EXPLANATION OF THE PLATES.

(Figures taken from photographs of dried specimens, about seven-eighths natural size.)

PLATE 26.

a. *Euphrasia micrantha* Rchb. Killin, 1929.
b. ,, ,, ,, Ben Vrackie, 1907.
c. ,, ,, ,, f. *simplex* Pugsl. Bigland Tarn, W. H. Pearsall, 1919.
d, e. *E. scotica* Wettst. Braemar, 1923.
f. ,, ,, f. *estriata* Pugsl. Clova, 1921 (Pugsley, No. 428).
g, h. ,, ,, var. *purpurascens* Pugsl. Rannoch, 1920 (Pugsley, No. 449).

PLATE 27.

a, b, c. *E. latifolia* Pursh. Corrie Ardran, Perthshire, 1929.
d, e. ,, ,, Craig-na-lochan, Perthshire, 1929.
f. *E. foulaensis* Towns. Melvich, E. S. Marshall, 1897 (No. 1853).
g, h. ,, ,, Unst, Shetland, R. J. Burdon, 1921.
i. ,, ,, f. *condensata* Pugsl. Orkney, W. I. Fortescue, 1890.
j. ,, ,, var. *maritima* Pugsl. Thurso, 1927 (Pugsley, No. 437).

PLATE 28.

a, b, c. *E. rotundifolia* Pugsl. Melvich, E. S. Marshall, 1897 (No. 1850).
d. ,, ,, Melvich, E. S. Marshall, 1915 (No. 4115).
e, f, g. *E. Marshallii* Pugsl. Melvich, 1927 (Pugsley, No. 476).
h. ,, ,, var. *pygmæa* Pugsl. Shetland, R. J Burdon, 1921.

PLATE 29.

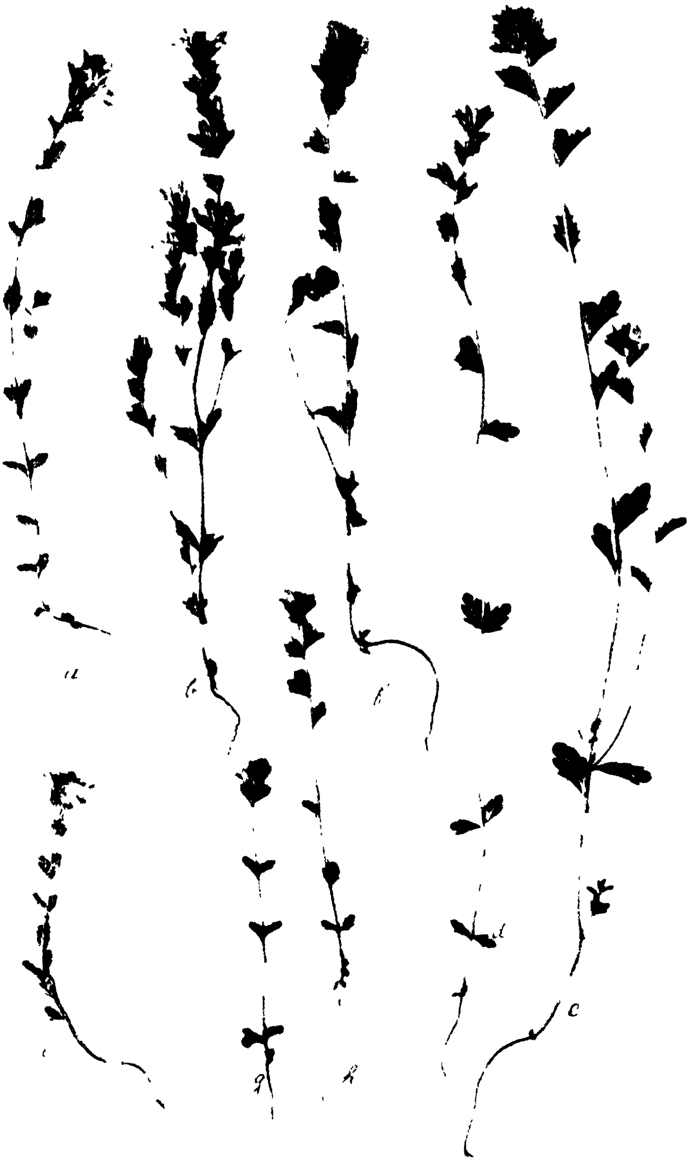
a. *E. curta* Fr. St. Anne's, Lancashire, C. Bailey, 1907.
b. ,, ,, Clova, 1921.
c. ,, ,, f. *littoralis* Neum. St. Anne's, Lancashire, C. Bailey, 1902.
d, e, f. ,, ,, var. *rupestris* Pugsl. Tryfan, 1925 (Pugsley, No. 429).
g. *E. cambrica* Pugsl. Cwm Clwyd, 1925.
h. ,, ,, Cwm Bochlwyd, 1922 (Pugsley, No. 430).
i. ,, ,, Snowdon, Miss Armitage, 1919.
j, k. ,, ,, Snowdon, 1922 (Pugsley, No. 432.)

PLATE 30.

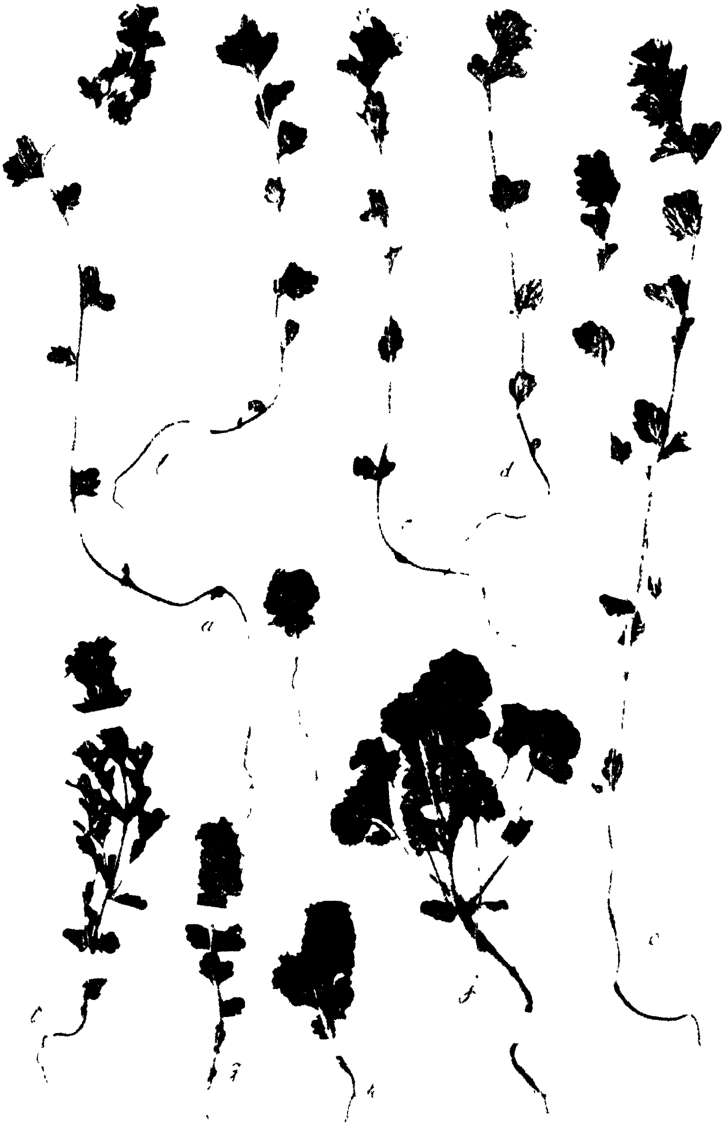
a. *E. occidentalis* Wettst. Portland, E. S. Marshall, 1898 (No. 2061).
b. ,, ,, Mullion, W. B. Waterfall, 1924.
c. ,, ,, var. *præcox* Bucknall. Woolacombe, 1901.
d. ,, ,, var. *minor* Pugsl. St. Agnes, H. S. Thompson, 1925.
e. ,, ,, var. *calvescens* Pugsl. Swanage, 1912.
f. *E. nemorosa* Löhr. Holmwood, Surrey, E. C. Wallace, 1928.

PLATE 31.

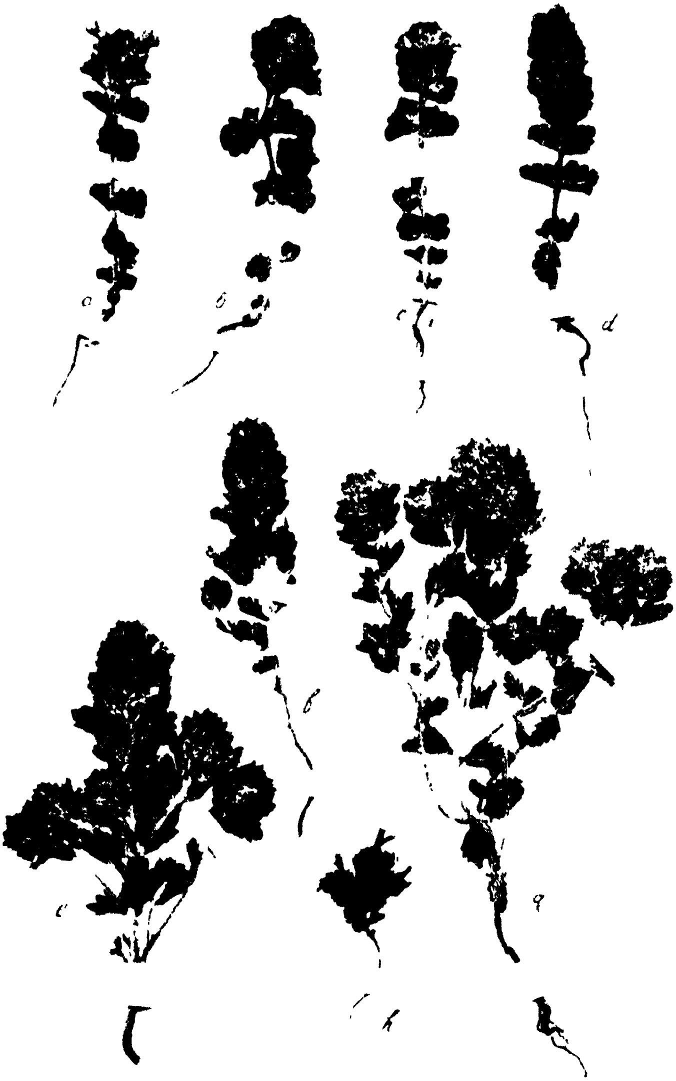
a. *E. nemorosa* Löhr, var. *calcarea* Pugsl. Box Hill, Surrey, 1920 (Pugsley, No. 442).
b. ,, ,, ,, *collina* Pugsl. Borrowdale, 1927 (Pugsley, No. 477).
c. ,, ,, ,, *sabulicola* Pugsl. Sands of Barrie, 1923.
d. ,, ,, ,, *transiens* Pugsl. Wimbledon, 1906.



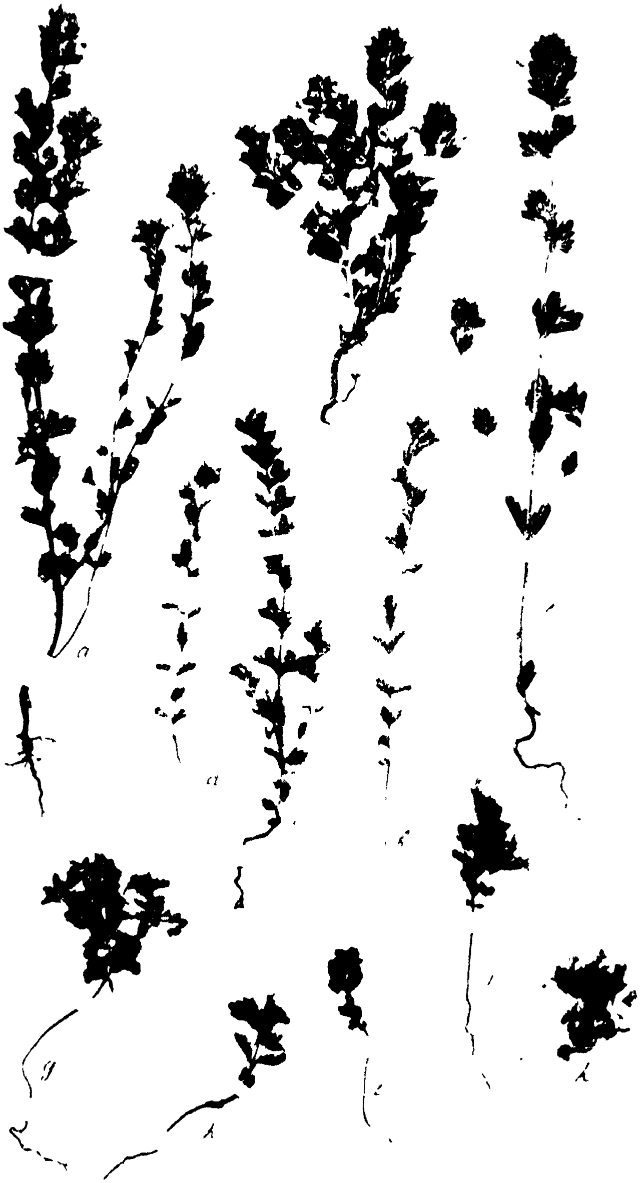
EUPHRASIA MICRANTHA & E. SCOTICA



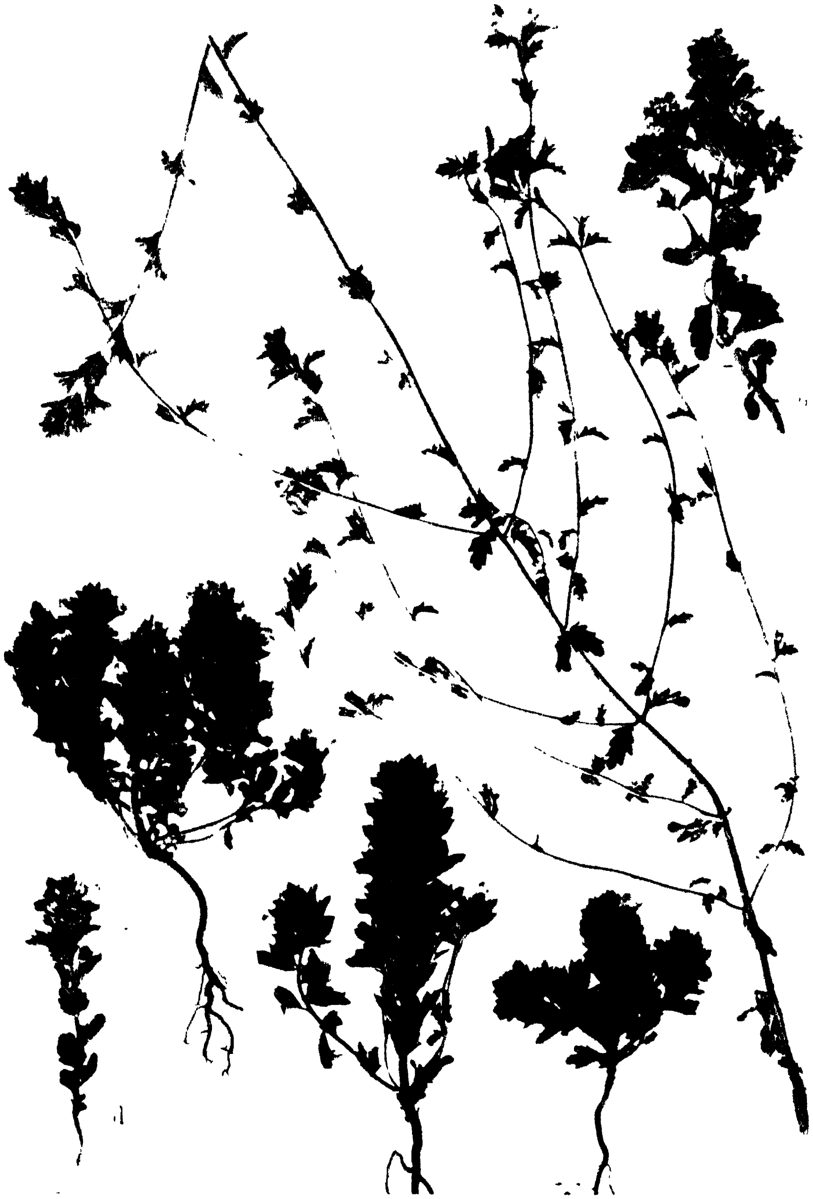
EUPHRASIA LATIFOLIA & E. FOULAENSIS



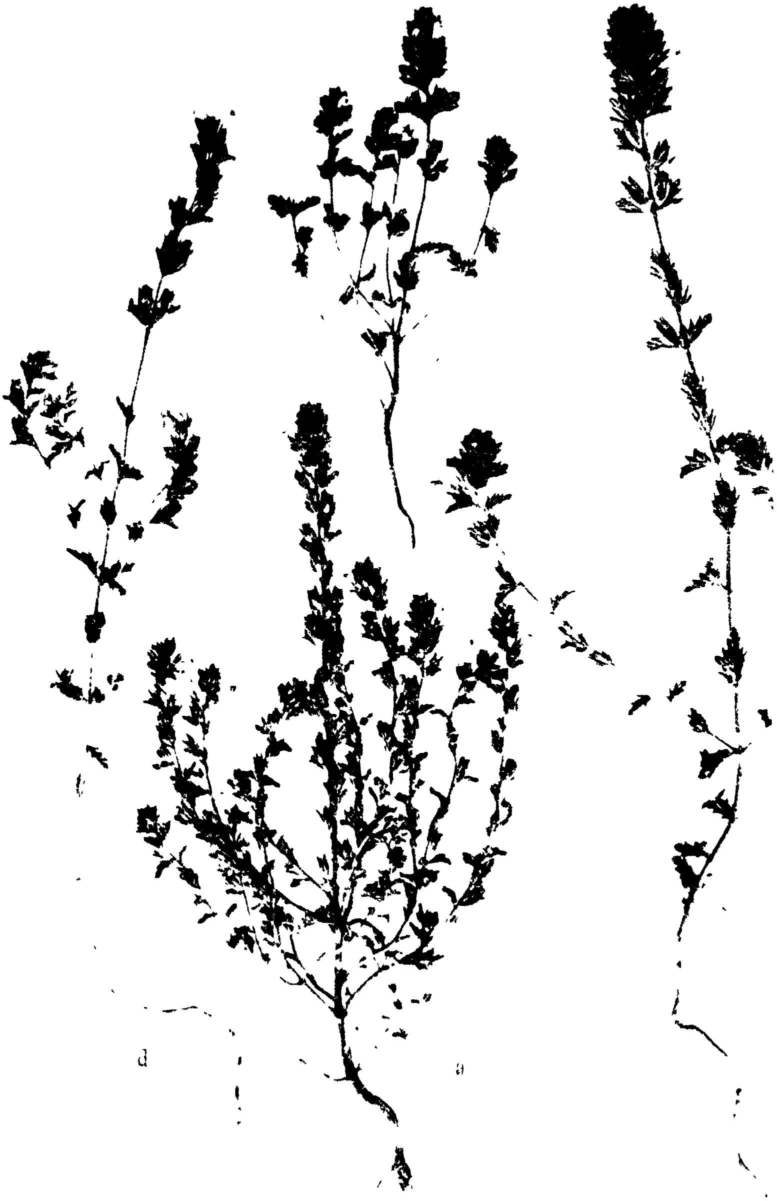
EUPHRASIA ROTUNDIFOLIA & E. MARSHALLII



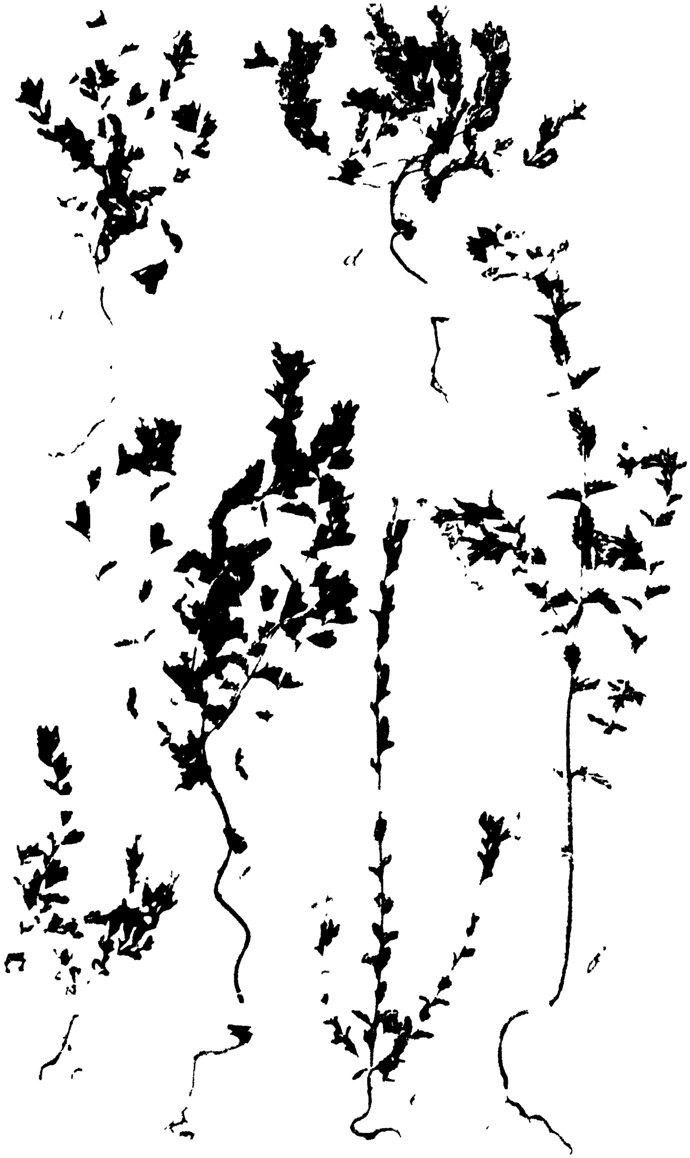
EUPHRASIA CURTA & E. CAMBRICA



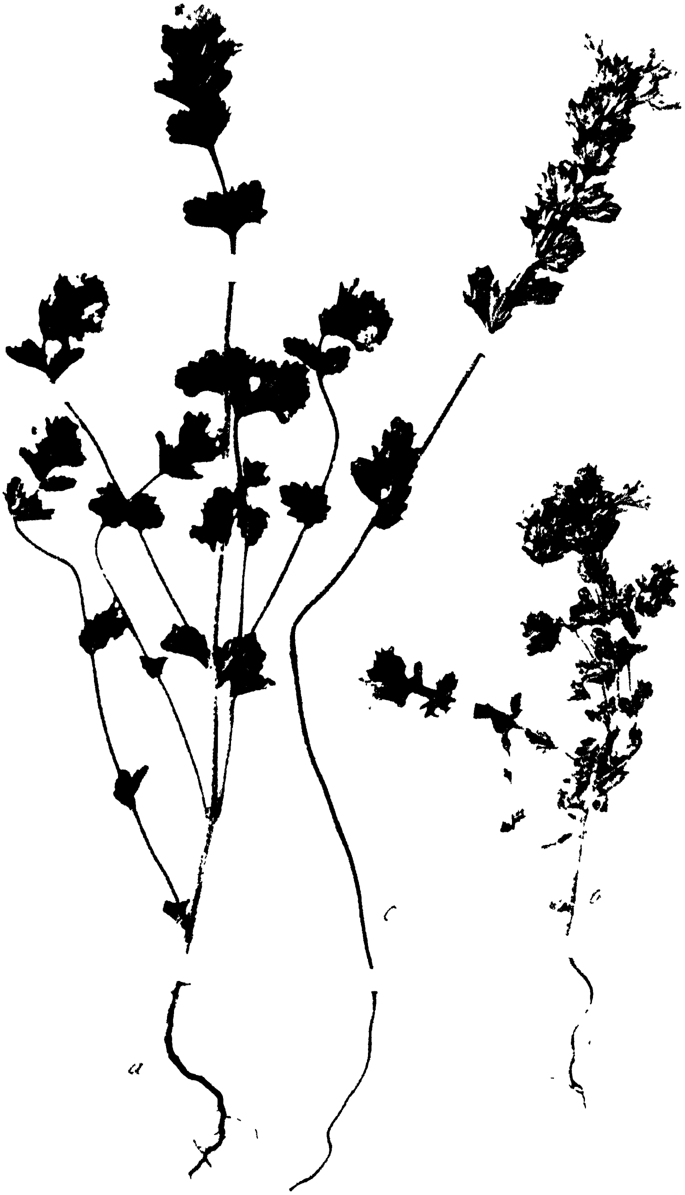
EUPHRASIA OCCIDENTALIS & E. NEMOROSA



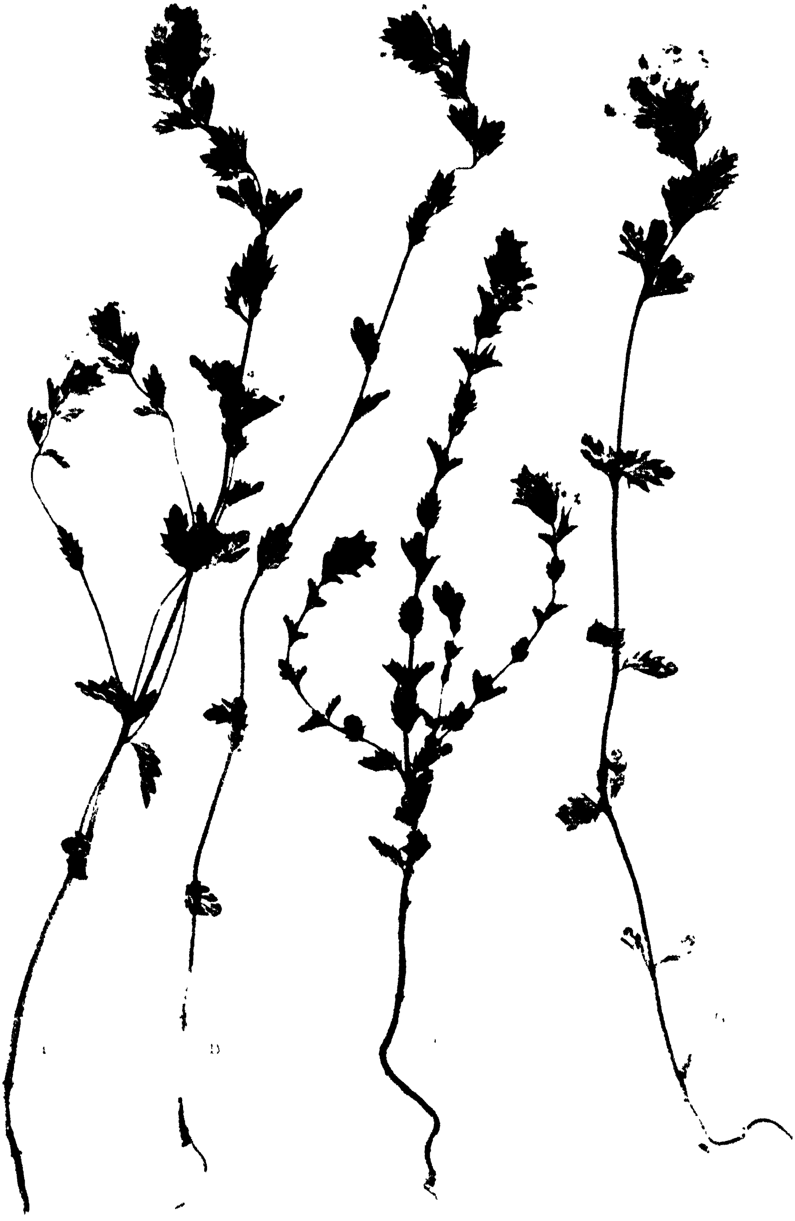
EUPHRASIA NEMOROSA



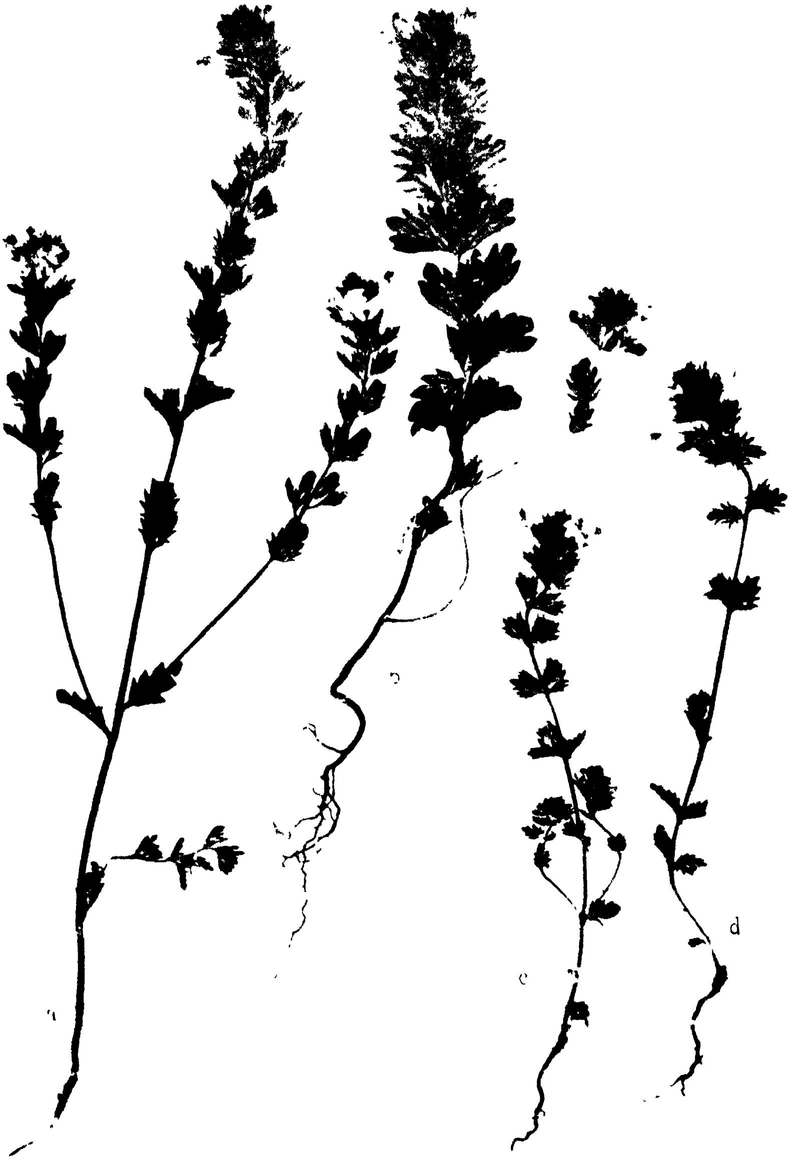
EUPHRASIA CONFUSA & E. PSEUDO-KERNERI



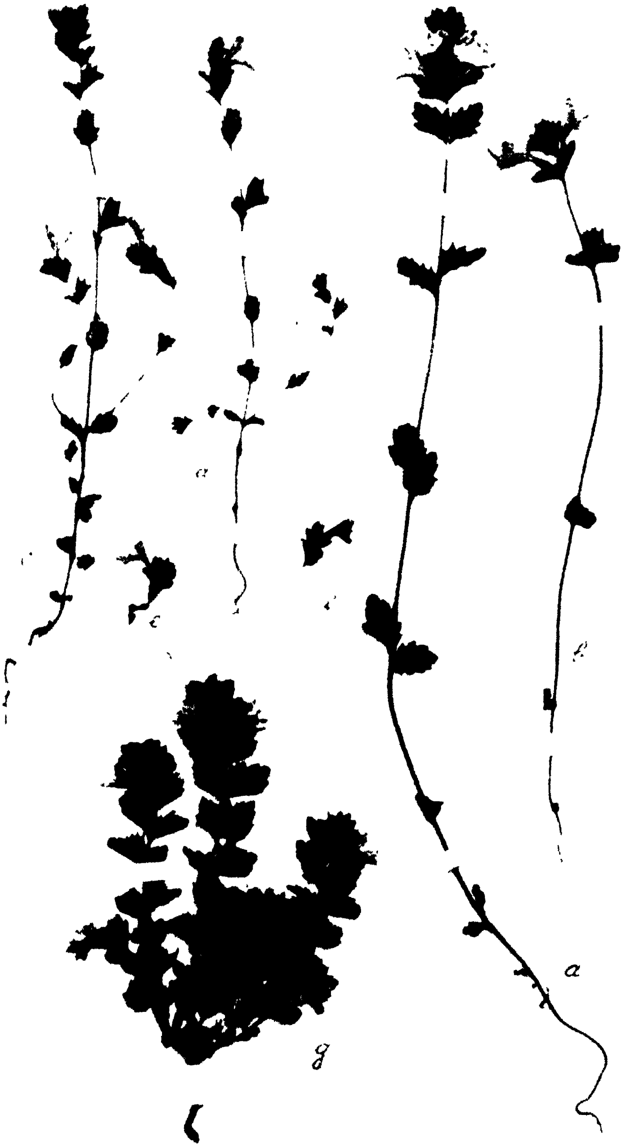
EUPHRASIA BOREALIS



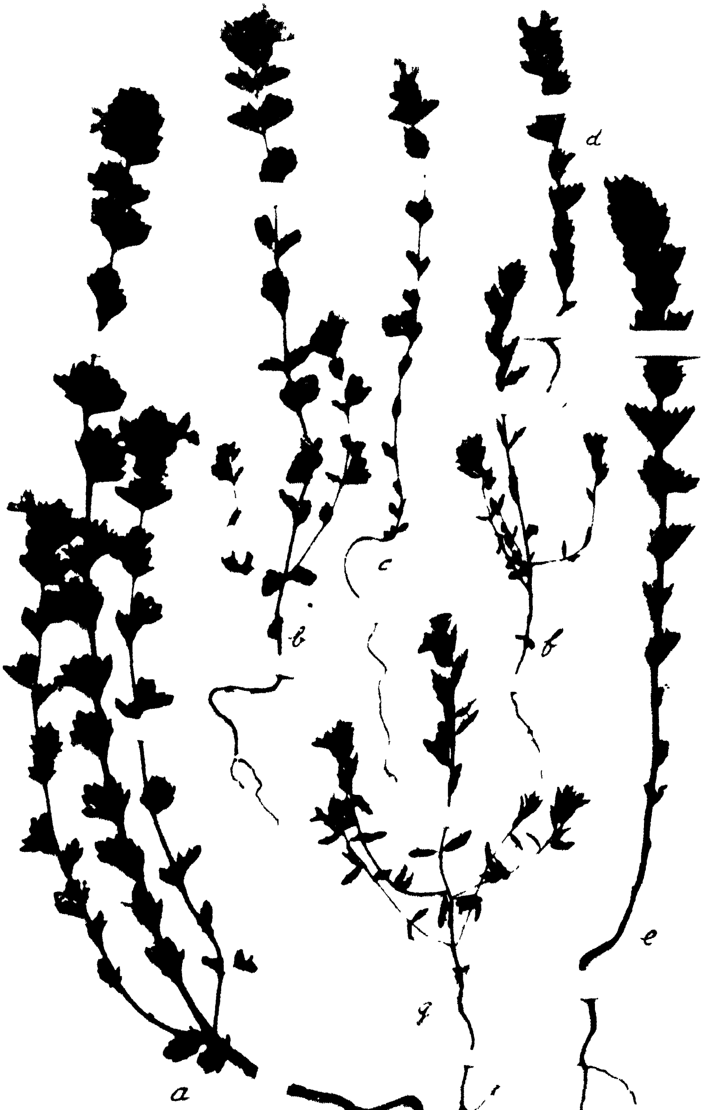
EUPHRASIA BREVIPILA



EUPHRASIA BREVIPILA & E. ROSTKOVIANA



EUPHRASIA MONTANA, E. RIVULARIS & E. ANGLICA



EUPHRASIA ANGLICA, E. HIRTELLA & E. SALISBURGENSIS

PLATE 32.

a. *E. confusa* Pugsl. Simonsbath, E. S. Marshall, 1918 (No. 4440).
b. ,, ,, Withypool, E. S. Marshall, 1918 (No. 4443).
c. ,, ,, Simonsbath, 1919.
d. ,, ,, var. *atroviolacea* Pugsl. Orkney, H. H. Johnston, 1926 (No. 3485).
e. *E. Pseudo-Kerneri* Pugsl. Box Hill, Surrey, 1920 (Pugsley, No. 448).
f. ,, ,, Reigate Hill, 1900.

PLATE 33.

a. *E. borealis* Towns. Keswick, 1903.
b. ,, ,, var. *zetlandica* Pugsl. Shetland, R. J. Burdon, 1921.
c. ,, ,, var. *speciosa* Pugsl. Shetland, R. J. Burdon, 1921.

PLATE 34.

a, b. *E. brevipila* B. & G. Fort William, 1920.
c. ,, ,, f. *gracilior* Pugsl. Jedburgh, R. J. Burdon, 1921.
d. ,, ,, f. *tenuiformis* Pugsl. Tongue, E. S. Marshall, 1897 (No. 1844).

PLATE 35

a. *E. brevipila* B.& G.,var. *notata* Pugsl. Lawers, Perthshire,1929 (Pugsley, No. 451).
b. ,, ,, ,, *reayensis* Pugsl. Reay, Sutherland, 1927 (Pugsley, No. 435).
c d. *E. Rostkoviana* Hayne, var. *obscura* Pugsl. Pendayn, H. J. Riddelsdell, 1901.

PLATE 36.

a. *E. montana* Jord. Grassington, Yorkshire, 1919.
b. ,, ,, Teesdale, J. G. Baker, 1870.
c, d. *E. rivularis* Pugsl. Nant Francon, 1925 (Pugsley, No. 438).
e, f. ,, ,, f. *compacta* Pugsl. Snowdon, 1922 (Pugsley, No. 439).
g. *E. anglica* Pugsl. Box Hill, Surrey, 1920 (Pugsley, No. 440).

PLATE 37.

a. *E. anglica* Pugsl. Simonsbath, E. S. Marshall, 1918 (No. 4433).
b, c. ,, ,, var. *gracilescens* Pugsl. Lynmouth, W. C. Barton, 1917 (No. 277).
d, e. *E. hirtella* Jord., var. *polyadena* Pugsl. Llanberis, 1917 (Pugsley, No. 441).
f, g. *E. salisburgensis* Funck, var. *hibernica* Pugsl. Ballynort, C. H. Waddell, 1908.

INDEX.

A star * denotes a name here published for the first time. Synonyms are shown in italics.

- Euphrasia *Linn.*, 484.
  - anglica *Pugsl.*, 527.
    - var. gracilescens * *Pugsl.*, 528.
  - *arctica* Lange, 490, 492.
  - *atropurpurea* Rostrup, 492.
  - *atroviolacea* Druce & Lumb, 511.
  - borealis *Towns.*, 515.
    - var. speciosa * *Pugsl.*, 516.
    - ,, zetlandica * *Pugsl.*, 516.
  - brevipila *Burnat & Gremli*, 517.
    - f. gracilior * *Pugsl.*, 518.
    - f. tenuiformis * *Pugsl.*, 518.
    - var. notata * *Pugsl.*, 519.
    - ,, reayensis * *Pugsl.*, 519.
  - cærulea *Tausch*, 482.
  - cambrica *Pugsl.*, 501.
  - campestris *Jord.*, 481, 529, 539.
    - var. *neglecta* Bucknall, 538.
  - confusa *Pugsl.*, 510.
    - var. atroviolacea * *Pugsl.*, 511.
  - curta *Fries*, 498.
    - f. littoralis *Neuman*, 499.
    - var. glabrescens *Wettst.*, 500.
    - ,, piccola * *Pugsl.*, 499.
    - ,, rupestris * *Pugsl.*, 499.
  - curta × brevipila, 537.
  - curta × nemorosa, 536.
  - fennica *Kihlm.*, 482.
  - foulaensis *Towns.*, 492.
    - f. condensata * *Pugsl.*, 493.
    - var. maritima * *Pugsl.*, 493.
  - frigida * *Pugsl.*, 490.
  - *gracilis* Fries, 486.
  - hirtella *Jord.*, 530.
    - var. polyadena * *Pugsl.*, 531.
  - *Kerneri* Bucknall, 512.
  - Kerneri *Wettst.*, 480, 513.
  - latifolia *Pursh*, 490.
    - f. grandiflora *Wettst.*, 495.
  - Marshallii *Pugsl.*, 496.
    - var. pygmæa * *Pugsl.*, 497.
  - micrantha *Reichb.*, 486.
    - f. simplex * *Pugsl.*, 487.
  - micrantha × anglica, 535.
  - micrantha × brevipila, 535.

- Euphrasia
  - micrantha × scotica, 534.
  - *minima* Hiern, 510.
  - minima *Jacq.*, 481, 489.
  - montana *Jord.*, 524.
  - nemorosa *Löhr*, 505.
    - var. calcarea * *Pugsl.*, 506.
    - ,, ciliata *Drabble*, 509.
    - ,, collina * *Pugsl.*, 506.
    - ,, sabulicola * *Pugsl.*, 506.
    - ,, tetraquetra *Bréb.*, 504, 508.
    - ,, transiens * *Pugsl.*, 507.
    - f. procumbens * *Pugsl.*, 507.
  - nemorosa × anglica ?, 539.
  - nemorosa × brevipila, 538.
  - nemorosa × confusa, 537.
  - nemorosa × Pseudo-Kerneri, 537.
  - *nitidula* Reut., 505, 508.
  - occidentalis *Wettst.*, 502.
    - var. calvescens * *Pugsl.*, 503.
    - ,, minor * *Pugsl.*, 503.
    - ,, præcox *Bucknall*, 503.
  - officinalis *Linn.*, 467.
  - *paludosa* Towns., 488.
  - *polyadena* Gren. & Roux, 531.
  - Pseudo-Kerneri *Pugsl.*, 512.
    - f. elongata * *Pugsl.*, 513.
  - rivularis *Pugsl.*, 525.
    - f. compacta * *Pugsl.*, 526.
  - Rostkoviana *Hayne*, 522.
    - var. minuta *Beck*, 527.
    - ,, obscura * *Pugsl.*, 522.
  - rotundifolia *Pugsl.*, 494.
  - salisburgensis *Funck*, 532.
    - var. hibernica * *Pugsl.*, 533.
  - scotica *Wettst.*, 488.
    - f. estriata * *Pugsl.*, 489.
    - var. purpurascens * *Pugsl.*, 489.
  - scotica × brevipila, 536.
  - stricta *Host*, 480.
  - suecica *Murb. & Wettst.*, 482.
  - variabilis *Druce & Lumb*, 511.
  - *Vigursii* Davey, 535.
    - var. pallens *Bucknall*, 536.

The Herbal of Leonhart Fuchs. By T. A. SPRAGUE, D.Sc., F.L.S and E. NELMES, The Herbarium, Royal Botanic Gardens, Kew.

[Read 29th November, 1928.]

1. *The Foundations of Modern Botany.*

The herbals of Otto Brunfels and Leonhart Fuchs may be taken as a convenient starting-point for modern taxonomic botany, mainly on account of the excellence of their illustrations, a high proportion of which can be identified with certainty. They thus furnish a large body of well-authenticated first records of medicinal plants wild or cultivated in Europe, and by means of the synonymy cited afford an invaluable key to mediæval and fifteenth-century botany. The text of these herbals, however, contains relatively little original matter, that of Brunfels consisting chiefly of extracts from classical and mediæval writers and from the Italian botanists of the fifteenth and early sixteenth centuries, while the descriptions of plants in Fuchs's 'Historia,' which on superficial inspection might appear, to those unversed in classical botany, to be largely original, are for the most part reproduced from Dioscorides either verbatim or more or less paraphrased.

Sachs's claim that a new epoch of natural science commenced with Brunfels, Bock, and Fuchs, and that they laid the foundations of modern botany, lacks justification—at any rate, so far as Brunfels and Fuchs are concerned *—and ignores the debt of these writers to their Italian predecessors. As Greene (1909, p. 166) has pointed out, "we shall not be able to realise how far the 'German Fathers' contributed to the superstructure of modern botany until we have examined with great care and diligence their best works and this is something which . . . . not even the German historians have been at the pains of doing though Sprengel, first of their lineage, did much and well in this direction, while also leaving very much for others to accomplish."

The foundations of modern botany were laid by the Italians. The manuscript herbal (c. 1415) of Benedetto Rinio, 'Liber de simplicibus Bened. Rinii medici et philosophi veneti,' contains 458 descriptions of simples and 443 figures by the skilful painter Andrea Amaglio. These include about 216 (46 per cent.) of the species figured in Fuchs's herbal more than a century later. The first edition of Pliny's 'Historia Naturalis' was published at Venice in 1469.

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* Bock comes in a different category. As Greene (1909) observed, Bock should be "ranked among the fathers of phytography, and even as the first of them in point of time after Theophrastus." Brunfels and Fuchs were far less original.

Pietro d'Abano (1253–1316) was the first to translate Dioscorides, 'Materia Medica,' into Latin: his translation appeared in 1478. Teodoro Gaza (1398–1478) made the first Latin translations of Theophrastus, 'De Historia Plantarum' and 'De Causis Plantarum,' published at Treviso in 1483. The earliest commentators on Pliny and Dioscorides were Italians: Ermolao Barbaro (1454–1493), Patriarch of Aquileja, author of 'Castigationes Plinianæ' (1492) and 'In Dioscoridem corollariorum libri V' (1516); Niccolò Leoniceno (1428–1524), Doctor of Medicine, and Professor in the University of Ferrara, and author of 'De Plinii et aliorum medicorum erroribus' (1492); and Pandolfo Colenuccio (d. 1504), whose 'Pliniana defensio adversus N. Leonicenum' appeared in 1493. A new translation of Dioscorides, 'Materia Medica,' by Marcello Vergilio (1464–1521) appeared in 1518. It was in Italy that the first herbaria were formed by Luca Ghini and his students, the earliest one extant, that of Gherardo Cibo, dating from about 1532. The first Chair of "Simplicia Medicamenta" was founded at Padua in 1533. It was in Italy that the first botanic gardens were established, that at Padua in 1545, followed by others at Pisa and Florence about 1547 and 1550 respectively.

Among the Italian authors quoted by Brunfels and included in the list of authorities at the beginning of his herbal (vol. i. ed. 2) are Giorgio Valla (1430–1499) and Giovanni Manardo (1462–1536), in addition to Ermolao Barbaro, Leoniceno, Colenuccio, and Marcello Vergilio. The only fifteenth- and sixteenth-century botanists prior to Brunfels mentioned in the introduction to Fuchs's 'Historia' are Ermolao Barbaro, Marcello Vergilio, and Jean Ruel (1474–1537), the celebrated French physician, translator of Dioscorides, and author of 'De natura stirpium libri tres' (Paris, 1536). Brunfels and Fuchs would have been the last to deny that the revival of botany was due primarily to the Italians.

The name of Pietro Andrea Mattioli (1500–1577) cannot be omitted here, though he was a contemporary, not a predecessor, of Fuchs: the first Italian edition of his Commentaries on Dioscorides was not published until 1544, the illustrated Latin edition appearing ten years later. Sachs (1875, p. 31) passed over Mattioli, relegating him to a brief footnote, ostensibly on the ground that Mattioli's writings were concerned chiefly with medicine and relatively little with botany. "Den Pierandrea Mattioli . . . . können wir übergehen, da bei ihm neben den medicinischen Interessen die botanischen wenig in Betracht kommen." Actually, Mattioli was a greater botanist than either Brunfels or Fuchs, as is evident from a study of his herbal. This passed through sixty-one editions, and contained 1200 original figures including 100 new species. Its importance in the history of botany was recognized by Gilibert (1798) and Sternberg (1821), who published concordances of the names used by Mattioli with those of Linné.

The second stage in the post-mediæval evolution of taxonomic botany began when it was realized that much of the earlier work was relatively valueless, owing to doubts regarding the identity of the plants concerned. Here German botanists took the lead. The need for precision was met by the provision of recognizable illustrations in the herbals of Brunfels and Fuchs, who—together with Mattioli—may be aptly styled "sixteenth-century fathers of plant iconography," and by the provision of original morphological descriptions in the works of Bock and Valerius Cordus, who take a higher rank as "sixteenth-century fathers of phytography."

2. *Life of Fuchs.*

The best accessible biographies of Fuchs are those by Roth (1898), Greene (1909), and Stübler (1928). Leonhart Fuchs was born of well-connected parents at Wemding, near Nördlingen in Bavaria, on January 17th, 1501. The loss of his father, when Leonhart was about five years old, may possibly have contributed to his precocious development and to the formation of his strong personality. He received his early education at Wemding, and when in his tenth year was sent by his mother to Heilbronn to attend the celebrated school of Magister Conrad, under whom he studied the Latin classics, and afterwards to the Marienschule at Erfurt and the University of Erfurt, where he qualified as Baccalaureus while still in his early teens. When about sixteen years old he opened a school at Wemding on the advice of his friends and relations, but after teaching there for less than two years went to the University of Ingolstadt in 1519, in order to pursue the study of Latin, Greek, and Philosophy, and later of Medicine, obtaining the degree of Master of Arts in 1521 and that of Doctor of Medicine in 1524. While at Ingolstadt he read the works of Martin Luther, and became an ardent Protestant.

After two years of private practice as a physician at Munich, where he married Anna Fridberger, who bore him four sons and six daughters, he was appointed Professor of Medicine at Ingolstadt in 1526, relinquishing this position in 1528 in order to become physician to the Markgraf Georg von Brandenburg at Ansbach, where he was able to give free expression to his religious views. Here—with a brief interval in 1533—Fuchs remained for seven years, obtaining a high reputation as a physician in 1529 by his successful treatment of a deadly epidemic known as the English Sweating Sickness. His first important published work was his 'Errata recentiorum medicorum' (Hagenau, 1530), in which he opposed the employment of chemical medicines, and warmly recommended the use of vegetable drugs. Part of this was included under the title "Annotationes de simplicibus a medicis hactenus perperam intellectis et æstimatis" in the second volume of Brunfels's herbal, published in 1531. This was followed by many purely medical writings, including his 'Paradoxorum medicinæ libri tres' (1535). In 1533 Fuchs had received a call as Professor of Medicine at Ingolstadt, but was prevented by religious antagonism from taking up his duties there.

The last thirty-one years of Fuchs's life, from August 1535 to May 1566, were spent at Tübingen as Professor of Medicine. There he prepared his herbal in the scanty leisure afforded by a strenuous academic and professional career. He was at first much occupied in helping to promote the Reformation in Tübingen and in the re-organization of the University, and he was also a prolific author and editor, the number of his published works, including translations, commentaries, medical works, and controversial pamphlets listed by Stübler, amounting to 36, apart from the various editions of his herbal. The first edition was a folio volume in Latin published by Michael Isingrin at Basel in 1542 under the title 'De historia stirpium commentarii insignes,' a considerably revised German edition following in 1543. Three further editions with illustrations much reduced in size appeared in 1545, two being octavo works without text, entitled respectively 'Primi de stirpium historia commentariorum tomi vivæ imagines' and 'Läbliche abbildung und contrafaytung aller kreuter.' The third was a small folio entitled 'Den Nieuwen Herbarius,' with a Dutch text translated from the German edition of 1543. The original Latin herbal of 1542 contained 511 figures, and six additional ones were included in the subsequent editions.

The wood blocks of the small figures were afterwards sold by Isingrin to the Paris printer Gazeau, who used them to illustrate a French edition published in 1549. The blocks then came to London for the illustration of Turner's New Herball (1551), afterwards passing into the possession of the publisher Vanderloe at Antwerp, who used 497 of them in the first (1554) and second (1563) Dutch editions of Dodoens's 'Cruydeboeck' and the French translation of Dodoens (1557) prepared by Charles de l'Ecluse (Clusius). The same figures also served to illustrate Jarava's Spanish translation of Fuchs's herbal published at Antwerp in 1557. They also appeared in Lyte's edition (1578) of Dodoens's herbal.

After the publication of his herbal Fuchs began to prepare a second volume, which was apparently ready for the press at latest in 1550, but he was unable to find a publisher for it. Undeterred by this, he began the preparation of a third volume, and shortly before his death, which occurred in 1566, he wrote asking Herzog Albrecht von Preussen for a grant towards the cost of printing the entire work, which seems to have contained over 1500 illustrations. Twenty-five of the wood-blocks prepared for it are still preserved in the Botanical Institute at Tübingen, and three of the figures are reproduced by Stübler (1928).

3. *Preparation and General Characteristics of the Herbal.*

Fuchs seems to have begun the preparation of his herbal on his arrival at Tübingen in 1535, if not earlier. Stübler (1928, p. 67) suggests that he may have started it as early as 1532, on the ground that Fuchs had recommended Brunfels's herbal as a textbook in the first edition of his 'Compendium Medicinæ' (1531), but omitted this recommendation in the second edition, the preface of which is dated 1532. Stübler explains this omission by anxiety on the part of Fuchs not to prejudice beforehand the circulation of his own herbal, but a possible alternative explanation is that Fuchs, whose critical faculty was highly developed, had in the meantime discovered numerous errors in Brunfels's work, and felt that he could no longer conscientiously recommend it. In the preface to his 'Historia' Fuchs mentions that Brunfels's figures do not always correspond to the descriptions, and that the names used by him are often incorrect. On the other hand, Euricius Cordus (1534, p. 14) mentions that Fuchs had promised to issue a new book of Pandects, and if this was his 'Historia' Fuchs must have contemplated the preparation of that work at least as early as 1533.

In a letter dated 24th October, 1538, addressed to Herzog Albrecht von Preussen, Fuchs stated that he had in preparation a herbal containing over 350 pictures of plants. As the completed work published in 1542 included 511 illustrations, it may be conjectured that the two draughtsmen began their work soon after Fuchs had settled down in Tübingen, probably early in 1536, and that about 100 figures were executed per annum, the last being completed about the end of the year 1540.

As a rule, Fuchs does not cite actual localities for plants in his herbal, but those that he does mention are mostly from the neighbourhood of Tübingen. On the Osterberg (Mons Austriacus) he found *Botrychium Lunaria*, *Ophioglossum vulgatum*, *Gagea lutea*, *Lilium Martagon*, *Listera ovata*, *Filipendula hexapetala*, and *Oxalis Acetosella*; on the Farrenberg, *Phyllitis Scolopendrium*, *Paris quadrifolia*, and *Gentiana lutea*; on the Spitzberg, *Peucedanum officinale*. He recorded *Cochlearia Armoracia*, *Isatis tinctoria*, *Ribes Uva-crispa*, *Vincetoxicum officinale*, *Anchusa officinalis*, *Symphytum officinale*, and *Senecio Fuchsii* also from the neighbourhood of Tübingen. Near the monastery of Bebenhausen he found *Gagea lutea*, *Leucojum vernum*, *Anemone ranunculoides*, and a white variety of *Thymus Serpyllum*. Other localities mentioned by Fuchs are Rotenburg am Neckar (*Lycopsis arvensis*, *Ajuga Chamæpitys*, a white variety of *Stachys officinalis*, and *Teucrium Chamædrys*), Nürtingen am Neckar (*Scilla bifolia*, white-flowered form, and *Satureja Acinos*), Cannstadt (*Apium graveolens*), Luschenau (*Muscari* and *Scilla*), Ingolstadt (*Melittis Melissophyllum*), Onoltzbach (*Symphytum officinale*, *Melittis Melissophyllum*), Nuremberg and the river Pegnitz (*Anchusa officinalis*, *Polygonum Hydropiper*, *Cucumis Melo* var. *Cantalupo*), the Black Forest (*Polygonum Bistorta*, *Meum athamanticum*), and Strasburg (*Lilium croceum*, *Eryngium campestre*). Fuchs also mentioned Hagenau, Speier, and Strasburg as the principal centres of cultivation of Madder (*Rubia tinctorum*), Aach and Erfurt for Woad (*Isatis tinctoria*), and Babenberg, near Bamberg, Bavaria, as famous for the cultivation of Liquorice (*Glycyrrhiza glabra*).

The aspect of the countryside seems to have been rather different in Fuchs's day, judging from his frequent citations of certain types of habitat. The land was then much less drained, and there were many lakes, meres, pools, and ponds *. The open field system of agriculture prevailed, areas of arable land being separated, not by walls, fences, or hedges, but by balks (" Reinen "), *i. e.*, strips of grassy turf, which afforded congenial habitats to a considerable variety of plants*. Gardens, on the other hand, were enclosed, frequently by wattle-fences, judging from early sixteenth-century illustrations †. Fuchs distinguished various types of " garden ": the " Krautgarten " was the kitchen-garden, or in a more restricted sense the cabbage-patch, while the " Zwiebelgarten " was the onion-patch. Vineyard and orchard were " Weingarten " and " Grassgarten," respectively. Rue (*Ruta graveolens*), Marjoram (*Origanum Majorana*), Chillies (*Capsicum* spp.), and *Lavandula Stoechas* were among the plants grown in the herb-garden (" Würtzgarten ").

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* *Vide* nos. 7, 23, 85, 86, 88, 102, 127, 148, 149, 152, 183, 184, 261, 291, 302, 303, 359, 412, 426, 469, 480, 501 in the Identifications of the Figures (pp. 572–634).

Church (1919), who made a detailed examination and comparison of the illustrations in Brunfels and Fuchs, showed that Fuchs's draughtsmen, Heinrich Füllmaurer and Albrecht Meyer, in various instances (e. g., *Nuphar luteum, Nymphæa alba, Sanicula europæa, Tussilago Farfara*) copied or adapted the figures in Brunfels's herbal, even when they had fresh specimens before them. This may perhaps be the explanation of Fuchs's extremely puzzling figure of "*Plantago minor*" (Hist. 39), in which the foliage seems to have been adapted from "*Plantago minor*" Brunfels (Viv. Eic. i. 24), which is *Plantago lanceolata* L., whereas the scapes appear to have been drawn from a living plant of *P. media* L.

Church also drew attention to the very unequal merit of the figures in Fuchs's herbal, and suggested that the inferior ones were the earlier, the finer designs representing the result of several years' experience. May it not be that at least some of the difference is due to the unequal powers of the two draughtsmen ? As Church himself has pointed out (1919, p. 233, footnote ‡), Meyer is represented in the plate " Pictores operis " as making an uncommonly bad attempt at drawing a Corn Cockle (*Agrostemma Githago*), and this may not have been entirely " a joke on the part of the other man who drew it."

Some of the figures were intentionally composite : thus both sexes of the admittedly diœcious *Cannabis sativa* (No. 222) were represented on a single plant, and two kinds of Strawberry (No. 488) were combined in a single picture. Other examples are *Rosa* (No. 374) and "*Gnaphalium*" (No. 125). Plants too large to be rendered life-size, even on the noble folio page of the ' Historia,' were shortened by the omission of the middle part of the stem, as in *Echinops sphærocephalus* (No. 503). Sometimes this abbreviation and the accompanying reduction has led to mistakes in identification, the figure of *Epilobium hirsutum* (No. 278), for example, having been listed by Sprengel as *E. roseum* Schreb.

The printing of the ' Historia ' seems to have been spread over a considerable period : when dealing with genera with names beginning in " D " Fuchs included Beerwurtz (*Meum athamanticum*) in *Daucus* (p. 231), but by the time he arrived at the letter " T " he had transferred this species to the genus *Tordylon* (p. 809).

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* *Vide* nos. 26, 56, 136, 138, 181, 227, 343, 429, 450, 460, 473, 488, 494, 495, 513.

† Marsilius Ficinus, 1515, fol. A iiii, verso.

No attempt to understand Fuchs's herbal can be successful unless the following considerations are borne in mind :—

(1) It was primarily, if not entirely, concerned with vegetable drugs, and the plants included in it therefore do not represent by any means all those known to Fuchs. Among other plants incidentally mentioned by him are *Geum rivale* (N.K. Cap. XCLIII), *Filipendula Ulmaria* (N.K. Cap. LXV), *Parnassia palustris* (Cap. XLVIII), *Cynoglossum officinale* (Stinckender Hundszzung, N.K. Cap. CLV), and *Chondrilla juncea* (Geel Wegwart, N.K. Cap. CCLXIII). The very name of the genus "*Lunaria minor*" (*Botrychium Lunaria*), commonly used in Fuchs's day, implied the existence of another larger "*Lunaria*" well known to his contemporaries. This was evidently "Honesty" (*Lunaria annua* L.), which according to Gesner (1561) was grown in gardens in Germany under the name "*Lunaria Græca.*"

(2) Fuchs's classification was primarily pharmaceutical or economic, and secondarily philological. His training and studies had been so largely linguistic that he attached undue importance to philological considerations : he seems to have reasoned that plants which possessed similar names must *ipso facto* possess similar properties, and should therefore be placed in the same genus. Details of his methods of classification are given on pp. 556–559.

(3) For Fuchs, the virtual starting-point of plant-nomenclature and taxonomy was the 'Materia Medica' of Dioscorides, though a few names were adopted by him from Theophrastus. Any proposal to ignore classical botany and to make a fresh start in the sixteenth century would have seemed absurd as well as revolutionary to Fuchs, far more so indeed than a proposal to substitute the year 1901 for 1753, as the starting-point of nomenclature, would appear to an average modern taxonomist. The numerous puzzling features in Fuchs's nomenclature are explained on pp. 559–562.

(4) Old matter and new are frequently so interwoven in the herbal that Fuchs's original observations can be detected only by means of exhaustive comparison with the text of previous writers. The descriptions of the plants known in classical times are mostly copied from Dioscorides, but additional particulars are occasionally supplied by Fuchs. Dioscorides described *Gentiana* as follows : "Huius folia, quæ quidem proxime radicem sunt, iuglandi plantaginive similia, subrubentia, quæ vero in medio sunt caule, maximeque in apice, minute fissa sunt. Caulis inanis, lævis, digitum crassus, bicubitalis, geniculis distinctus et maioribus ex intervallis foliis circumdatus. Semen vero habet in calycibus latum, leve, paleaceum, quod ad sphondylii semen accedit. Radix longa, qualis aristolochiæ longæ, crassa et amara. Nascitur in celsissimis montium iugis, locis umbrosis aquosisque." Fuchs has virtually the same description, with the following additional sentence : "Flores eius lutei primum calycibus conclusi, postea intumescentes explicantur." This is apparently original.

There is comparatively little evidence in the 'Historia' of borrowing from

Bock, but the text of Fuchs's 'New Kreüterbuoch' shows considerable indebtedness to that author, some of whose descriptions are reproduced almost verbatim, for example, those of *Veronica agrestis* (No. 11), *Plantago media* (No. 22), *Borago officinalis* (No. 77), *Lilium candidum* (No. 207), and *Petasites hybridus* (No. 367).

The habitats of the species are mostly copied from Dioscorides, though they are sometimes—especially in the 'New Kreüterbuoch'—supplemented or even replaced by the actual habitats in which Fuchs had seen the plants growing in Germany (*cf.* Nos. 461, 473, *Euphorbia helioscopia* and *Hypericum perforatum*). With reference to *Centaurium umbellatum* (No. 219), Fuchs actually went so far as to observe: "Although Dioscorides writes that it grows in wet and damp places, yet everyone knows that with us it commonly grows in hard dry grassy fields and meadows."

(5) Fuchs's use of the terms "male" and "female" was purely conventional and traditional, implying no recognition of sex in plants. In this respect he was less enlightened than Theophrastus, who had applied the epithets "male" and "female," respectively, to barren and fruit-bearing kinds of trees. Fuchs, on the contrary, accepted the current nomenclature, according to which the seed-bearing Dog's Mercury (*Mercurialis annua* L.) was known as *Mercurialis mas*, an instance of phallic symbolism, and the staminate plant as *Mercurialis fœmina*. With Brunfels the terms "male" and "female" had still retained a certain cabbalistic significance, apparently connected with colour and properties supposedly correlated therewith (*vide* Sprague, 1928, p. 87), but with Fuchs they became quite meaningless: he had two kinds of *Balsamine*, and called them "male" and "female," respectively, merely in order to distinguish them. He reversed Brunfels's allocation of sexes to the violet-flowered *Verbena officinalis* and the yellow-flowered *Sisymbrium officinale*, designating the former as "female" and the latter as "male," because he supposed that Pliny had applied these terms in that way.

4. *Objects and Arrangement of the Herbal.*

Pharmacy in Germany was in a deplorable condition in the early part of the sixteenth century, as is evident from the following passage in Fuchs's "Dedicatory Epistle": "The times once were when not only great philosophers and poets, but kings and princes both investigated plants, and favoured others so occupied. But in our day even the physicians are so much averse to that kind of study that you will hardly find one among a hundred of them who has correct knowledge of even a very few kinds. They appear to think that this kind of information does not belong to their profession, and to judge that it would be condescending from their proper dignity to entertain doubts about the accuracy and trustworthiness of those who buy and sell such things. And so it comes to pass that the druggists—God knows that they themselves are for the most part an illiterate set—leave all this to the foolish and superstitious old women who gather herbs and roots. Error is therefore heaped on error, and will be so long as the identification of vegetable medicines is left to rustic and vulgar ignorance" (translated and condensed by Greene, 1909, p. 197).

The primary object of the herbals of Brunfels and Fuchs was to remedy this state of affairs and to place pharmacy and medicine on a sound historic basis by identifying the plants described or mentioned by Dioscorides, Galen, and Pliny, and supplying a life-like illustration of each. Such botanical and philological information as was supplied in Fuchs's 'Historia' was strictly subsidiary to this main purpose of reforming the German pharmacopœia.

For nearly fifteen centuries Dioscorides had been accepted as the supreme authority on medicinal plants, and his 'Materia Medica' was accordingly the pattern on which Fuchs's 'Historia Stirpium' was implicitly modelled. The 'Historia' is subdivided into 344 "capita" or chapters (numbered I–CXI and CXI *bis*–CCCXLIII), 267 (77·6 per cent.) of which correspond with those of Dioscorides. An additional 23 chapters (6·7 per cent.) are taken from Pliny (16), Theophrastus (4), Apuleius Barbarus (2), and Galen (1), the total number of classical and post-classical ones being 290 (84·3 per cent.). Of the remaining 54 chapters, 42 (12·2 per cent.) are mediæval, and only 12 (3·5 per cent.) can be ascribed to Fuchs himself.

On the reverse of the titlepage there is a full-length figure of Fuchs at the age of 41. This is followed by the Dedicatory Epistle to the Markgraf Joachim von Brandenburg, in which Fuchs, after lamenting the low estate to which pharmacy has fallen, gives a brief account of the outstanding figures in the history of the subject, including Theophrastus, Dioscorides, Pliny, Galen, Hermolaus Barbarus, Ruellius, Marcellus Vergilius, Brunfels, Euricius Cordus, Valerius Cordus, and Hieronymus Bock. He explains that he adopted an alphabetical arrangement as a matter of convenience, while recognizing that it would have been better to follow the sequence of Dioscorides and to place related plants side by side.

For the convenience of his less learned readers Fuchs supplied a glossary of technical terms occurring in his text. As a separate section, this was something of an innovation, though numerous definitions of terms occur scattered among names of plants in the fourteenth-century 'Liber Pandectarum' of Matthæus Sylvaticus, for example :—

"Bacca (Bacha) id est fructus olive vel lauri vel edere : et sunt fructus vel grana rotunda" (Cap. lxxv).

"Borra est quedam albedo cum aliquali pilositate : ut apparet in foliis calamenti" (Cap. cvii).

"Botrus : id est forma uve composita ex racemis" (Cap. cx).

"Bulbus est omnis radix tunicata" (Cap. cx).

Many of the terms are taken from Pliny, *e.g.*, "internodium" and "scapus." The originality of the glossary seems to have been exaggerated.

There are four indexes, the first giving the Greek names of the plants, the second the classical Latin names, the third the (mostly mediæval Latin) names used in the druggists' shops and by the herbalists, and the fourth including the vernacular German names. At the end of the volume are portraits of the two draughtsmen and of the engraver, Rudolf Speckle of Strasburg.

The general arrangement of the chapters is roughly according to their Greek names (or, in the absence of these, according to the Latin ones), in the sequence of the Greek alphabet: hence names beginning in " G " (Γ), e.g., *Geranium*, occur between those in " B " and " D " (Δ); and those beginning in " Hy " (Ὑ), " Ph " and " F " (Φ), "Ch " (X) and " Ps " (Ψ), e.g., *Hypericum*, *Phlomos* (Lat., *Verbascum*), *Fragaria*, *Chelidonium*, and *Psyllium* follow those in " T." The alphabetical arrangement is not carried beyond the initial letters.

The text of each ditypic or polytypic chapter (*i.e.*, genus) is subdivided into the following seven sections :—" Nomina," " Genera," " Forma," " Locus," " Tempus," " Temperamentum," " Vires." Under " Nomina " are the various names of the plant or plants, Greek, Latin, and German. Under " Genera " there is an account of the different " kinds " (*i.e.*, species): this section is, of course, absent in monotypic chapters. A brief morphological description is supplied under the title " Forma." Particulars of habitat and, very occasionally, actual localities follow under " Locus," while the times of flowering, seeding, and collection of the drug are given under " Tempus." " Temperamentum " included the general " complexion " of the drug, whether " cold " or " hot," " moist " or " dry," while " Vires " dealt with its specific properties and method of application.

5. *Bibliographical Sources of the Herbal.*

Fuchs seems, early in his career, to have acquired a very large collection of books, one of the reasons given by him in 1537 for refusing the post of Physician to King Christian III of Denmark being the difficulty of transporting his extensive library (Stübler, 1928, p. 172).

He unfortunately gave no bibliography in his herbal, but the works of the following authors were undoubtedly consulted by him, some of them being mentioned in his Introduction, and others in the main body of the text, chiefly under the heading " Vires ": Theophrastus (B.C. 370–285), Dioscorides (fl. A.D. 64), Pliny (A.D. 23–79), Galen (130–201), Oribasius (325–403), Aëtius (fl. 540–550), Plinius Valerianus (c. 600), Isidorus (c. 570–636), Paulus Æginetes (first half of 7th century), Simeon Seth (fl. 1071–1078), Ermolao Barbaro (1454–1493), Marcello Vergilio (1464–1521), Jean Ruel (1474–1537), Otto Brunfels (1489–1534), Euricius Cordus (1486–1535), Valerius Cordus (1515–1544), Hieronymus Bock (1498–1554). In order to facilitate reference, the titles of the works in question are included in the Bibiliography at the end of this paper (pp. 639–642), not all of them being contained in Pritzel's ' Thesaurus.' In the 343 chapters of Fuchs's Latin herbal under the heading " Vires," there are 272 extracts from Dioscorides, 235 from Pliny, 229 from Galen, 45 from Simeon Seth, 28 from Paulus Æginetes, 15 from Aëtius, 6 from Plinius Valerianus, 3 each from Theophrastus and Apuleius Barbarus, 2 from Columella, and 1 each from " Marcus Æmylius " (*i. e.*, Æmilius Macer, c. 1140), " Symeon Antiochenus," and Actuarius (13th century).

The "auctores Græci recentiores," whose opinions are frequently quoted in Fuchs's 'Historia' included Aëtius, Paulus Æginetes, and Actuarius, according to a marginal note on p. 358 of that work; and the Byzantine Court official, Symeon Seth, evidently belonged to the same category.

The proof that Fuchs consulted Isidorus is contained in the glossary of botanical terms at the beginning of the 'Historia,' where the long definition of "malleolus" is almost identical with that given in Isidorus, lib. XVII, cap. v, no. 5. Other definitions exhibiting a family resemblance to those of Isidorus include those of "flagella," "stipulæ," and "folliculus." Isidorus was cited in the Latin 'Ortus Sanitatis' (1490 and later editions) under *Borago*, *Cipressus*, *Symphicum*, etc., so that his work was evidently well known in the fifteenth and sixteenth centuries.

Judging from internal evidence, the Latin translation of Dioscorides used by Fuchs was that of Ruel, probably the edition published at Strasburg in 1529. Ruel adopted the name *Alsine* instead of *Myosota* (*Muris auricula*), and gave the locality of *Helenium* as "montanis, umbrosis et siccis locis," whereas Marcello Vergilio had *Myosota* (*Muris auricula*), and "montanis umbrosis nec uliginosis locis," respectively. Fuchs's text agrees in each case with that of Ruel. The above data are taken from Mattioli's 'Commentarii' (1554), pp. 47, 489, and Ryff's edition of 'Dioscorides' (1543), pp. 20, 331, for the text of Ruel, and from the Cologne edition (1529), pp. 50, 319, of Marcello Vergilio's translation, as the original editions are not accessible at the time of writing.

6. *Mediæval (or Sixteenth-century) and new Genera.*

The origin of the 42 mediæval and sixteenth-century genera in Fuchs's 'Historia' is instructive. The generic names may be placed in the following groups, according to the sources whence Fuchs obtained them:—

(1) From more recent authors: 5 (*Angelica*, *Caryophyllata*, *Cassutha*, *Satyrion-basilicum*, *Spanachia*).

(2) From an ancient manuscript herbal: 1 (*Succisa*).

(3) Commonly used in Fuchs's day: 17 (*Aquilegia*, *Alliaria*, *Uva-crispa*, *Balsamine*, *Viola-matronalis*, *Centummorbia*, *Lunaria-minor*, *Mala-insana*, *Pastoria-bursa*, *Perfoliata*, *Sanicula*, *Scabiosa*, *S.-Barbaræ-herba*, *Sanguisorba*, *Trinitatis-herba*, *Turcicum-frumentum*, *Fragaria*).

(4) Foreign names: 2 (*Ribes*, *Sorgi*).

(5) Used by the herbalists: 15 (*Veronica*, *Uva-crispa*, *Consolida media*, *Cardiaca*, *Pilosella*, *Pimpinella*, *Pes-leonis*, *Potentilla*, *Prunella*, *Persicaria*, *Pulmonaria*, *Solidago-sarracenica*, *S.-Iacobi-flos*, *Saxifraga-maior*, *Serpentariæ*).

(6) Used in the druggists' shops: 6 (*Euphrasia*, *Pimpinella*, *Ribes*, *Saxifraga-maior*, *Serpentariæ*, *Sphatula-fœtida*).

(7) Used by the physicians: 2 (*Prunella*, *Pulmonaria*).

(8) Used by some people: 1 (*Genistella*).

Seven of the 42 names occur in two categories, namely, *Uva-crispa* (categories 3 and 5), *Ribes* (4 and 6), *Pimpinella*, *Saxifraga-maior*, *Serpentariæ* (5 and

6), *Prunella, Pulmonaria* (5 and 7). From inspection of the list it is obvious that Fuchs borrowed more from the herbalists than from any other class, though not citing them so frequently as did Brunfels. Evidently their knowledge of medicinal plants was wider than that possessed by the druggists and physicians.

The twelve generic names proposed by Fuchs himself fall into four categories :

(1) Names indicating that the drugs had been wrongly identified : *Elleborus-niger-adulterinus, Eupatorium-adulterinum, Cynoglossum-officinarum* [non Dioscoridis].

(2) Latin (or Greek) translations of the popular German names : *Cruciata* (Creutzwurtz), *Digitalis* (Fingerhuot), *Ophioglossum* (Naterzünglin), *Pes-anserinus* (Genszfuosz), *Saxifraga-lutea* (Steinbrech, Geeler Klee) *Tinctorius-flos* (Ferbbluemen).

(3) Names derived from resemblance or shape : *Barba-capri* (in allusion to the straggling inflorescence), *Campanula* (from the bell-shaped flower).

(4) Name indicating segregation : *Trifolium-pratense* (segregated from the ancient genus *Trifolium*).

7. *Fuchs's Taxonomy.*

Examination of Fuchs's "capita" shows that they are essentially pharmaceutical rather than taxonomic categories. In many cases they roughly correspond in rank and contents, however, with what would now be termed genera, though they are frequently more comprehensive. Thus *Allium* Fuchs consisted of several species of *Allium* L. ; *Aizoon* (*Sedum*) Fuchs comprised, in modern nomenclature, one *Sempervivum* and three species of *Sedum* ; *Geranium* Fuchs covered one *Erodium* and five species of *Geranium* ; and *Batrachium* (*Ranunculus*) Fuchs contained five species of *Ranunculus* and two of *Anemone*.

Seventeen of the "capita" (genera) include species now referred to two or more different families. The association of such diverse elements under one generic heading was due to a variety of causes :—

(1) Erroneous identifications with species of a Dioscoridean genus : e.g., *Sisymbrium Sophia* L., identified with *Absinthium marinum* (*Seriphium*) Diosc., and consequently placed beside *Artemisia Absinthium* L. ; *Delphinium Consolida* L., taken for *Chamæmelum Eranthemon* Diosc. ; *Paris quadrifolia* L., determined as *Aconitum Pardalianches* Diosc. ; *Corydalis cava* Schweigger et Körte, identified with *Pistolochia* Pliny, which was a fourth kind of *Aristolochia* ; *Chenopodium Bonus-Henricus* L., referred to *Lapathum tertium sylvestre* Diosc. ; *Mentha aquatica* L. and *Nasturtium officinale* R. Br., identified respectively with *Sisymbrium* Diosc. and *Sisymbrium Cardamine* Diosc. ; *Primula veris* L. and *P. elatior* Schreb., referred erroneously to *Phlomis* (*Verbasculum*) Diosc.

(2) Association of two species, one referred to a Dioscoridean genus, and the other to a *different* Plinian genus bearing the *same* or a *similar name* ; e.g., *Helichrysum arenarium* Moench, referred to *Helichrysum* (*Amarantos*) Diosc., and *Celosia cristata* L. to *Amarantus* Pliny (both characterized by everlasting

flowers); *Epilobium hirsutum* L., identified with *Lysimachion* Diosc., and *Lysimachia vulgaris* L. with *Lysimachia* Pliny.

(3) Acceptance of mediæval genera: e.g., *Verbena*, composed of *Verbena officinalis* L. and *Sisymbrium officinale* Scop.

(4) Acceptance of current classification: *e.g.*, the genus *Hydropiper*, composed of *Polygonum Hydropiper* L. ("*Hydropiper*") and *Calla palustris* L., which some people of Fuchs's day considered to be a species of "*Hydropiper.*"

(5) Similarity in current names and in reputed properties: e.g., *Stellaria media* Vill. ("Huenerderm"), *Veronica agrestis* L. ("Huenerserb"), and *Arenaria serpyllifolia* L. ("Kleinvogelkraut"), all used by bird-catchers for getting cage-birds into condition; *Momordica Balsamina* L. ("*Balsamine*") and *Impatiens Balsamina* L ("*Balsaminum*"), both credited with balsamic properties; *Brassica Napus* var. *napobrassica* Reichb., *Beta vulgaris* var. *cruenta* Alef. (both named "*Rapum*"), and *Campanula Rapunculus* L. ("*Rapunculus*"), all possessing esculent tuberous roots.

(6) Association of a substitute with the genuine drug: e.g., *Heracleum Sphondylium* L. with *Acanthus mollis* L.

(7) Similarity in facies: e g., *Veronica* spp. associated with *Teucrium* spp.

(8) Similarity in fruits: *Physalis Alkekengi* L. and *Cardiospermum Halicacabum* L., both with bladder-like fruits.

Fuchs's "capita" (genera) fall into five groups according to the number of species included in them: monotypic chapters, 211 (61·3 per cent.); ditypic, 87 (25·3 per cent.); tritypic, 25 (7·3 per cent.); tetratypic, 12 (3·5 per cent.); penta-polytypic, 9 (2·6 per cent.). The total number of species actually mentioned by Fuchs being about 550, the ratio of species to genera was about 1½ : 1. According to Greene (1909, p. 241), the corresponding ratio in a sample of Bock's herbal was about 2½ : 1; the lower ratio in Fuchs's work was due to his including only medicinal and economic plants.

The "capita," when not monotypic, are subdivided into "genera," and these sometimes into secondary and even tertiary "genera." On the whole, the final subdivisions correspond with Linnean species, as may be seen in Fuchs's genus *Ranunculus*. In the text this is subdivided into four primary "genera," but on the plates these are termed "species," both terms being used in the general sense of "kind." His classification of *Ranunculus* was as follows:—

Prima species	sylvestris		*Ranunculus auricomus* L.
	hortensis	simplex	*R. arvensis* L.
		multiplex	*R. acris* L., flore pleno.
Secunda species			*R. sceleratus* L.
Tertia species			*R. bulbosus* L.
Quarta species	lactea		*Anemone nemorosa* L.
	lutea		*A. ranunculoides* L.

The species included in one of Fuchs's chapters (genera) do not all necessarily bear the generic name: thus cap. XX, *Sambucus*, contains two species named respectively *Sambucus* (proper) and *Ebulus*. Further illustrations are afforded by the chapters on *Artemisia*, *Solanum*, *Cucumis-sativus*, and *Verbascum*. *Artemisia* is composed as follows :—

1. *Artemisia latifolia* Diosc. (*Artemisia*)	*Artemisia vulgaris* L.
2 *Artemisia tenuifolia* Diosc. (*Matricaria*)	*Chrysanthemum Parthenium* Bernh.
3. *Artemisia monoclonos* Diosc. (*Tanacetum, Tagetes*)	*Tanacetum vulgare* L.
4. *Tagetes indica*	*Tagetes patula* L.

Fuchs implicitly recognized two primary subdivisions of *Artemisia*, namely, *Artemisia* (proper) and *Tagetes* (*Tanacetum*). He had no hesitation in identifying the plants now known as *Artemisia vulgaris* and *Chrysanthemum Parthenium* with the first two species of *Artemisia* Diosc. The Tansy (*Tanacetum vulgare*) was then known as *Tanacetum* (which according to Fuchs was a corrupt form of *Tagetes* Apuleius), and bore the popular German name " Reinfarn." He tentatively identified it with *Artemisia monoclonos* Diosc., and considered that his identification was supported by the fact that the first Dioscoridean species (*Artemisia vulgaris* L.) was sometimes given the similar German name " Grosser Reinfarn." As the " French Marigold " (*Tagetes patula* L.), then recently introduced into German gardens, approached the Tansy (" *Tagetes* ") in general facies, he named it *Tagetes indica*, in allusion to its exotic (Mexican) origin. There is no justification for Greene's statement (1909, p. 216) that Fuchs regarded it as an independent genus.

The chapter on *Cucumis* (*Cucumer*)-*sativus* affords a good example of Fuchs's classification into primary and secondary " genera " :—

Primum genus : absolutè *Cucumis* (*Cucumis citrinus*) :	
Primum genus : *Cucumis vulgaris*	*Cucumis sativus* L.
Alterum genus : *Cucumis Turcicus*	*Cucurbita Pepo* L. var. *oblonga* DC.
Tertium genus : *Cucumis marinus*	*C. Pepo* L. var. *rotunda* DC.
Quartum genus : *Cucumis Citrulus*	*Citrullus vulgaris* Schrad.
Alterum genus : *Pepo*	*Cucumis Melo* L. var. *Cantalupo* Ser.
Tertium genus : *Melon* [not figured]	*Cucumis Melo* L.

The manner in which the plants known to Fuchs were referred by him to those described by Dioscorides is well illustrated in his genus *Strychnos* (*Solanum*). He correctly identified *Strychnos hortensis* Diosc. and *Strychnos Halicacabus* Diosc. with the two species now known as *Solanum nigrum* and *Physalis Alkekengi* respectively, but *Atropa Belladonna* was a bad shot for *Strychnon somniferum*. He merely reproduced the original description of *Strychnon furiale* Diosc., as he had been unable to identify it. The exotic *Halicacabum peregrinum* (*Cardiospermum Halicacabum*) was intercalated after *Halicacabum vulgare* (*Physalis Alkekengi* L.), because it also had a bladder-like fruit ; and *Stramonia* (*Datura Metel*) was appended to the list because some people included it in *Solanum*, and it seemed to differ little in its properties from the other species.

Genus primum : *Solanum hortense*	*Solanum nigrum* L.
Genus secundum : *Halicacabum vulgare*	*Physalis Alkekengi* L.
Alia *Halicacabi* species : *Halicacabum peregrinum*	*Cardiospermum Halicacabum* L.
Genus tertium : *Solanum somnificum*	*Atropa Belladonna* L.
Genus quartum : *Solanum furiosum* [unknown to Fuchs].	
Genus aliud : *Stramonia*	*Datura Metel* L.

The classification of *Verbascum* and the names and descriptions of all the species were taken bodily from Dioscorides. Fuchs's identifications of German plants with those of the Mediterranean region were not very successful in this instance. His figures of the first three Dioscoridean species are, however, correct so far as the genus (*Verbascum* L.) is concerned. The remaining four species, which according to Sprengel (1830, p. 620) are referable to *Phlomis* (*Labiatæ*), were identified by Fuchs severally with *Verbascum nigrum* L., *Primula veris* L., *Primula elatior* Schreb., and *Verbascum phœniceum* L. (Scrophulariaceæ and Primulaceæ). A list of Fuchs's seven species with their modern equivalents is given below:—

Verbascum candidum mas	*Verbascum Thapsus* L.
fœmina	*Verbascum Lychnitis* L.
Verbascum nigrum	*Verbascum phlomoides* L.
Verbascum sylvestre	*Verbascum nigrum* L.
Verbasculum odoratum	*Primula veris* L. em. Huds.
Verbasculum non-odoratum	*Primula elatior* Schreb.
Lychnitis (*Thryallis*) [not figured]	*Verbascum phœniceum* L.

Certain improvements in classification were introduced in the 'Vivæ Imagines.' There Fuchs followed Bock (1539, cap. xxxii) in removing *Sisymbrium officinale* from *Verbena* and placing it with other Cruciferæ in *Sinapis*. He also removed *Sisymbrium Sophia* from *Absinthium*, associating it with *Lepidium sativum* under the generic name *Nasturtium*. *Delphinium Consolida* was transferred from *Anthemis* (*Chamæmelum*) and treated as an independent genus, *Consolida regia*. *Calla palustris* was taken from *Hydropiper* (*Polygonum Hydropiper*) and associated with another Aroid, *Dracunculus vulgaris* Schott. *Lilium Martagon* was placed with the other Lilies, and *Gentiana cruciata* beside *G. lutea*. *Trigonella cærulea* was associated with *Melilotus dentata* in the genus "*Lotus*."

On the other hand, *Equisetum palustre* was divorced from *E. arvense* in the 'Vivæ Imagines' and re-named *Polygonum fœmina*; and *Sium angustifolium* was treated as a congener of *Veronica Beccabunga*.

8. *Fuchs's Nomenclature.*

Fuchs employed a triple nomenclature in his herbal: Greek, Latin, and German. The chapters were headed by the Greek names used by Dioscorides, Galen, and Theophrastus, thus facilitating reference to the works of these authors, while the figures bore both Latin and German names, the Latin ones being those employed by Pliny and Apuleius Barbarus or by the druggists and herbalists of the sixteenth century.

The nomenclature accompanying the figures is at first sight extremely puzzling, and cannot be understood without reference to the text. It may be unitary, binary, ternary, or quaternary in nature, and uninominal, binominal, trinominal, or quadrinominal in form. But the essential nature of the nomenclature and its form do not necessarily correspond: thus a trinominal designation, for example, may be unitary, e.g., *Ephemerum non letale* (a monotypic genus), or binary, e.g., *Trifolium pratense purpureum* (a species of the genus

Trifolium pratense), or ternary, e. g., *Bellis minor hortensis* (a subdivision of the species *Bellis minor*).

Of the 514 different Latin designations on the figures, 182 are uninominal, 265 binominal, 62 trinominal, and 5 quadrinominal, while 244 represent a unitary nomenclature, 228 are binary, 39 ternary, and 3 quaternary. Only ten of them are essentially generic names—namely, *Cerasus*, *Gnaphalium*, *Gramen*, *Lamium*, *Mala insana*, *Papaver sativum*, *Pisum*, *Rosa*, *Serpyllum*, and *Tamarix*: the rest are generico-specific names of monotypic genera or of type-species, or names of other species (primary, secondary, or tertiary).

The 504 names of species ("genera") or their subdivisions fall into the following eight categories:—

(1) Unitary and uninominal: 174, e. g., *Asarum* (a monotype), *Sambucus* (a type-species), *Ebulus* (another species of the same genus, *Sambucus*), *Hedypnois* (a subspecies of *Intubum sylvestre*).

(2) Unitary but binominal: 57, e. g., *Plantago aquatica*, *Ruta hortensis*, and *Barba capri* (monotypes).

(3) Unitary but trinominal: 3, viz., *Ephemerum non letale*, *Sancti Iacobi herba*, *Sanctæ Barbaræ herba* (monotypes).

(4) Binary and binominal: 206, e. g., *Thlaspi latifolium*, *Geranium quartum*.

(5) Binary but trinominal: 20, e. g., *Spina alba hortensis* (a species of the genus *Spina alba*), *Sonchus non aspera* (a species of *Sonchus*).

(6) Binary but quadrinominal: 2, e. g., *Elleborus niger adulterinus hortensis* (a species of the genus *Elleborus niger adulterinus*).

(7) Ternary and trinominal: 3, viz., *Sedum minus mas*, *Malva sylvestris pumila*, *Quinquefolium maius luteum*.

(8) Quaternary and quadrinominal: 3, e. g., *Hyacinthus cœruleus mas minor*.

For the purposes of the above classification, designations such as *Sedi tertium genus* and *Ranunculi secunda species* have been counted as binominal, since they are virtually equivalent to *Sedum tertium* and *Ranunculus secundus*, respectively. Similarly, *Ranunculi quarta species lactea* has been counted as trinominal. It will be seen that practically half (256 out of 514) of the designations accompanying the figures conform to the conventions of modern nomenclature—namely, the eight uninominal generic names and those included in categories 4, 7, and 8.

A characteristic feature of mediæval plant-nomenclature was the large proportion of binominal or trinominal generic designations employed. This applies especially to the Latin names, various Greek generic uninominals corresponding to Latin binominals, e. g., *Eleoselinon* to *Apium palustre* and *Leucoion* to *Viola alba*. Out of 344 generic names employed by Fuchs, 272 (79 per cent.) are uninominal, 68 (20 per cent.) are binominal, and 4 (1 per cent.) trinominal. As the binominal and trinominal generic designations are apt to be mistaken for names of species and varieties respectively, it seems desirable to supply a complete list of them;—

Apium palustre, *Aster atticus*, *Avellana nux*, *Barba capri*, *Betonica altera*, *Bulbus sylvestris*, *Centaurium minus*, *Chamæleon albus*, *Chamæleon niger*, *Chelidonium maius*, *Chelidonium minus*, *Clematis daphnoides*, *Consolida media*, *Cotonea malus*, *Cucumis sativus*, *Cucumis sylvestris*, *Cynoglossum officinarum*, *Elleborus albus*, *Elleborus niger adulterinus*, *Ephemerum non letale*, *Eupatorium adulterinum*, *Ficus sativa*, *Helxine cissampelos*, *Herba Trinitatis*, *Laurus Alexandrina*, *Lunaria minor*, *Lupus salictarius*, *Mala insana*, *Napus Bunias*, *Nasturtium agreste*, *Nasturtium hortense*, *Papaver corniculatum*, *Papaver erraticum*, *Papaver sativum*, *Pastoria bursa*, *Pes anserinus*, *Pes leonis*, *Plantago aquatica*, *Polygonum mas*, *Polytrichum Apuleii*, *Rhodia radix*, *Ruta hortensis*, *Sanctæ Barbaræ herba*, *Sancti Iacobi herba*, *Satyrion basilicum*, *Satyrion trifolium*, *Saxifraga lutea*, *Saxifraga maior* (*Saxifraga alba*), *Serpentariæ officinarum*, *Seseli massiliense*, *Sideritis prima*, *Smilax aspera*, *Smilax hortensis*, *Smilax levis*, *Solidago sarracenica*, *Sphatula fœtida*, *Spina alba*, *Staphis agria*, *Stratiotes millefolia*, *Symphytum magnum*, *Tinctorius flos*, *Trifolium odoratum*, *Trifolium pratense*, *Triorchis Serapias*, *Turcicum frumentum*, *Uva crispa*, *Viola alba*, *Viola matronalis*, *Viola purpurea*, *Vitis alba*, *Vitis nigra*, *Vitis vinifera*.

Greene (1909, p. 216) listed a few of the binominal generic names employed by Fuchs, but two of those mentioned by him—namely, *Acorum officinarum* and *Tagetes indica* (*vide supra*, p. 558)—are actually binary names of species, as is evident from Fuchs's remarks.

Another feature of mediæval nomenclature occasionally observable in Fuchs's herbal was that the generic name did not necessarily precede the specific: thus *Seriphium Absinthium* Fuchs was a species of *Absinthium*, and *Maius Polytrichum Apuleii* was a species of *Polytrichum Apuleii*. Similarly, the components of a binominal generico-specific designation might be transposed: thus Fuchs has both *Herba Trinitatis* and *Trinitatis herba*, *Solidago sarracenica* and *Sarracenica solidago*. He was, in fact, not employing a conventional botanical nomenclature, but writing about plants in Latin—and in the Latin language such transpositions are legitimate.

Yet another characteristic of the early sixteenth-century herbals was the frequent absence of a distinction between accepted names and synonyms. An example occurs in Chapter CXCI, where two of the species bear the generic name *Melanthium*, while the third is under *Nigella*. A natural consequence of this attitude towards nomenclature was that the same author frequently adopted different names for the same plant in successive works: thus the species now known as *Tagetes patula* L. appeared under the name *Tagetes indica* in Fuchs's 'Historia' (1542) and as *Flos Indianus sive viola flammea* in his 'Vivæ Imagines' (1545).

Three of the twelve generic names proposed by Fuchs are still current for the same genera—namely, *Ophioglossum*, *Campanula*, and *Digitalis*. Twenty names of species employed by him are still used in the same sense, namely: *Aconitum Lycoctonum**, *Allium ursinum*, *Anagallis fœmina**, *Angelica sylvestris*, *Atriplex hortensis**, *Cannabis sativa**, *Chelidonium maius**, *Digitalis purpurea*, *Hedera Helix**, *Hordeum distichum*, *Iris germanica*, *Lactuca sativa**, *Lilium croceum*, *Origanum vulgare*, *Pimpinella maior*, *Plantago maior**, *Raphanus sativus**, *Smilax aspera**, *Sonchus aspera**, *Vitis vinifera**. Those names marked with an asterisk occur in Dioscorides. *Cucumis sativus* Fuchs and *Trifolium pratense* Fuchs, which were names of genera each composed of several species, are now restricted to one of the included species. *Eruca sativa* Fuchs is not *Eruca sativa* L., but *Diplotaxis tenuifolia* DC.

Fuchs recognized the inconvenience caused by homonyms without perceiving that the remedy was to discard one of them: thus he kept up both *Leucoïon* Diosc. and *Leucoïon* Theophr., and mentioned that there were two distinct species called *Viola alba* and two called *Viola purpurea*. He regarded the classical names of plants as so authoritative that he did not venture to change them.

9. *The Scientific Value of the Herbal.*

(1) Fuchs's herbal supplements that of Brunfels in affording clues to the identity of various plants known in mediæval times : to mention one example, the very crude figure of *Spatula fetida* (Wantlusz krut) given in 'Ortus Sanitatis' (Mainz, 1485), cap. ccclxi, may be safely identified as *Iris fœtidissima* L. on the strength of Fuchs's figure of *Sphatula fœtida* (Wandtleuszkraut).

(2) It contains the first certain records of over 100 plants wild or cultivated in Germany—*vide* p. 565.

(3) It affords valuable contemporary evidence of the introduction of certain cultivated plants into Germany during the early sixteenth century. Fuchs mentions eighteen species—ornamental, esculent, and medicinal—as recent introductions. The ornamental plants were the Balloon Vine (*Cardiospermum Halicacabum*), Garden Balsam (*Impatiens Balsamina*), *Anchusa azurea* (*A. italica*), Balsam Apple (*Momordica Balsamina*), and the French Marigold (*Tagetes patula*). The esculent plants and condiments included Maize (*Zea Mays*) and Sorghum (*Sorghum vulgare*), the Globe Artichoke (*Cynara Scolymus*), two varieties of the Pumpkin (*Cucurbita Pepo*), the Water Melon (*Citrullus vulgaris*), three kinds of Chilli (*Capsicum annuum*, *C. longum*, *C. cordiforme*), and Garden Thyme (*Thymus vulgaris*). The most important of the recently introduced medicinal plants was *Ricinus communis* †, the others being *Diplotaxis tenuifolia*, *Teucrium Scordium*, and *T. flavum*.

A further set of plants which Fuchs mentions as being "now cultivated in Germany" include Foxtail Millet (*Setaria italica*), *Aloë vera*, *Saponaria officinalis*, *Sedum roseum*, *Gossypium herbaceum*, *Ammi Visnaga*, Lovage (*Levisticum officinale*), *Solanum Melongena*, and *Cnicus benedictus*. It is somewhat surprising to learn that the Parsnip (*Pastinaca sativa* var. *edulis*), though planted in gardens, was not yet common in Germany. According to Gibault (1912) and Bois (1927) it was grown in France from the time of Charlemagne, and was an important food-plant before the introduction of the Potato, which largely superseded it. The cultivation of the Parsnip must have extended very rapidly in Germany, however, for Bock (1552) mentions that it was a staple food of the poorer classes during Lent. A parallel is afforded by Skirret (*Sium Sisarum*), which according to Brunfels (1536) was a luxury of the nobility, but is mentioned by Fuchs as being cultivated almost everywhere in kitchen-gardens.

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† *Ricinus communis* was, however, known to Albertus Magnus (Meyer and Jessen, 347) and Conrad von Megenberg (1482, fol. 149, verso).

(4) Many of the figures in Fuchs's herbal may be regarded as the " historic types " of Linnean names, specific and occasionally (e. g., *Ophioglossum*, *Paris*, *Digitalis*, *Tagetes*) generic. Linné, it is true, seldom cited Fuchs directly, contenting himself with quoting the corresponding name in Bauhin's ' Pinax ' in order to save space. Where he actually gives a direct reference to a figure in Fuchs's ' Historia,' it may be assumed that he regarded that figure as a good, if not the best, representation of the species. Out of the hundred new species in Fuchs only eleven figures are directly cited by Linné—namely, *Lichen pulmonarius*, *Arenaria serpyllifolia*, *Stellaria Holostea*, *Erysimum Alliaria*, *Thlaspi campestre*, *Sisymbrium sylvestre*, *Trifolium montanum*, *Hypericum montanum*, *Ballota nigra*, *Senecio sarracenicus* and *Sonchus arvensis*. The case of *Senecio sarracenicus* L. Sp. 871 is interesting. Although Linné took the specific epithet from Fuchs, citing *Solidago sarracenica* Fuchs as a synonym, yet Fuchs's plant is now excluded from *Senecio sarracenicus*, being treated either as an independent species, *S. Fuchsii* Gmel., or as a variety of *S. nemorensis* L.

(5) Fuchs's figures were extensively borrowed, copied, or adapted in later works : they were used in the herbals of Turner (1551), Bock (ed. Lat. 1552), Dodoens (1554, et ed. Gall. 1557), and Lyte (1578), and in Jarava's edition of Dioscorides (1557), which is really an abridged Spanish translation of Fuchs's herbal. Many were pirated in Ryff's edition of ' Dioscorides ' (1543) and in Lonitzer's ' Kreuterbuoch ' (1557). As the plants described in the text of these various books were sometimes not conspecific or even congeneric with the Fuchsian figures by which they were illustrated, it is essential to trace the origin of the latter in order to explain obvious discrepancies or to avoid mistakes in identification. Two examples may be given : the description of Rocket (*Eruca sativa* L.) in Turner, New Herball, part 1, fol. P 2, verso (1551), is accompanied by a figure of *Eruca sativa* Fuchs, which is *Diplotaxis tenuifolia* DC. ; and the description of Houndstongue (*Cynoglossum officinale* L.) in Bock, Comm. 230 (1552), is illustrated by a poor figure of *Echium vulgare* L. (*Cynoglossum officinarum* Fuchs).

10. *Fuchs's Place in the History of Botany.*

It is extremely difficult to assess the merits of Fuchs as a botanist, more especially since his later botanical work never saw the light. Greene considered that " no passion for nature study, or for plants in particular, was congenital with Fuchs," and that " as a botanist he was not born but made." A different impression may be gained from the following passage in Fuchs's

"Dedicatory Epistle" (fol. 2, verso) quoted by Arber (1912, p. 60): "There is no need for me to set forth to the multitude the pleasure and delight afforded by a knowledge of plants, since there is none but knows that there is nothing in this life more pleasant and delightful than to wander through woods and over mountains and fields wreathed and adorned with a variety of the choicest flowers and herbs, and to gaze on them attentively. This enjoyment and pleasure is in no small degree enhanced by a knowledge of their properties and powers: for real understanding doubles the charm and delight of vision."

Evidence of shrewd observation on the part of Fuchs is afforded by his remarks on the rooting of bramble turions, the changes in colour exhibited by the flowers of *Echium vulgare*, and the local distribution of the purple and the white-flowered varieties of *Symphytum officinale*. He did not disdain to mention that the maidens of Erfurt wore garlands in winter as well as in summer, using the everlasting flowers of *Celosia cristata* for the purpose; and that vile able-bodied mendicants made use of *Ranunculus sceleratus* to produce sores on their arms and legs in order to obtain alms from the compassionate.

It would be idle to expect much original descriptive matter in Fuchs—at least, in regard to plants known in classical times: he was still under the spell of Dioscorides, and considered that the descriptions of that author were final for purposes of identification, and that nothing might be either added to or subtracted from them. Where new plants were concerned, however, he had a free hand, but even there he seems to have felt that a good illustration rendered verbal description almost superfluous. Bock, on the other hand, held that figures were frequently useless for distinguishing plants which closely resembled one another, so that he refused to allow his 'New Kreutter Buoch' to be illustrated (*vide* Rihel's Preface). This belief led Bock to draw up those apt and pithy descriptions of plants which entitle him to be regarded as one of the founders of modern phytography.

Fuchs's prominent place in the history of botany is due not so much to any originality which he may have shown, as to the admirably methodical plan according to which he arranged his subject-matter, bringing together the researches of previous workers and incorporating them with his own. Brunfels had brought out the first herbal provided with really good illustrations: Fuchs far surpassed him in number of figures, as well as in their methodical arrangement. The Italian commentators and Brunfels had identified with greater or less success the plants of Dioscorides and other classical authors: Fuchs carried this process a step further, though with little success. Isidorus and Matthæus Sylvaticus had given definitions of various botanical terms: Fuchs embodied some of these with many other currently used terms in his own glossary.

Fuchs thus gave an invaluable picture of what was known about medicinal plants in Germany in his day, and supplied a solid basis for future research. As a botanist, however, he was an industrious, methodical, and judicious compiler, rather than an investigator.

11. *Systematic Conspectus of Plants figured.*

In order to give some idea of Fuchs's contributions to taxonomic botany, an attempt has been made to indicate which of his plants were known respectively to the ancient Egyptians, Greeks, and Romans, to the mediæval world, and to Brunfels. Out of 487 species and varieties in the following list, 289 (59 per cent.) appear to have been known to the ancients, and 64 (13 per cent.) in the Middle Ages, while 31 (6 per cent.) were first recorded by Brunfels. The remaining 103 (21 per cent.) † were first figured by Fuchs, though many of them had been previously described by Bock (1539). The precise extent of Fuchs's debt to Bock, however, cannot be estimated until the works of the latter author have been studied in detail.

Brunfels's herbal contained 258 species and varieties, of which 162 (63 per cent.) were classical, 49 (19 per cent.) mediæval, and 47 (18 per cent.) new. Only 211 of these were included in Fuchs's 'Historia,' the remaining 47, among which were many well-known plants such as *Narcissus Pseudo-Narcissus*, *Lychnis Coronaria*, *Anemone Hepatica*, *Dictamnus albus*, and *Asperula odorata*, being omitted, probably because Fuchs did not consider them to be of sufficient pharmaceutical importance. On the other hand, Fuchs had 276 additional plants, 103 of which were new, so that his 'Historia' represented a notable advance on Brunfels's 'Vivæ Eicones.'

Among the outstanding novelties illustrated by Fuchs were indigenous plants, such as *Botrychium Lunaria*, *Calla palustris*, *Paris quadrifolia*, *Stellaria Holostea*, *Alliaria officinalis*, *Barbarea vulgaris*, *Aruncus sylvester*, *Daphne Mezereum*, *Astrantia major*, *Digitalis purpurea*, and *Campanula Trachelium*. To him we owe also the first published figures of various cultivated plants, including *Triticum turgidum*, *Zea Mays*, *Ribes rubrum*, *Ribes Uva-crispa*, *Phaseolus vulgaris*, *Echinops sphærocephalus*, and *Tagetes patula*. One of the most interesting first records is that of *Diplotaxis tenuifolia*, which is apparently indigenous in southern Europe, but introduced in the north. Fuchs figured it under the name "*Eruca sativa*," as a recently introduced medicinal plant, cultivated in gardens. The first record for Europe cited by Thellung (1913) is Strasburg, 1740.

The following abbreviations are employed to indicate previous records for the various species :—

A.	Albertus Magnus, *fide* Meyer et Jessen (1867).
AEL.	Ancient Egyptian, *fide* Loret (1887).
AES.	Ancient Egyptian, *fide* Schweinfurth (1884, 1887).
AET.	Ancient Egyptian, *fide* Tschirch (1909).
AR.	Mediæval Arabian, *fide* Sprengel (1817).
ART.	Mediæval Arabian, *fide* Tschirch (1909).
B.	Apuleius Barbarus (Bodley MS.) *fide* Gunther (1925).
Br.	Otto Brunfels, *fide* Sprague (1928).
C.	Columella, *fide* Sprengel (1817).
CV.	Dioscorides, Codex Vindobonensis, ed. Karabacek (1906).
D.	Dioscorides, *fide* Sprengel (1871).

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† This does not include cultivated varieties of *Beta*, *Brassica*, and *Lactuca*.

HB. Hieronymus Brunschwig, Buoch von Distillierung (1515).
M. Mediæval Italian, *fide* Saccardo (1909).
ME. Mediæval European, *fide* Watt (1907).
N. Nicander, *fide* Sprengel (1817).
OS. Ortus Sanitatis (1485).
Ov. Ovid, *fide* Sprengel (1817).
P. Pliny, *fide* Sprengel (1817).
PD. Pliny, *fide* Dyer (1921).
R. Classical Roman, *fide* Saccardo (1909).
RD. Classical Roman, *fide* Dyer (1921).
T. Theophrastus, *fide* Hort et Dyer (1916).
V. Virgil, *fide* Sprengel (1817).
* Not previously figured (or recorded, except by Bock).

LICHENES : Lobaria pulmonaria*.

HEPATICÆ : Marchantia polymorpha (Br.).

MUSCI : Polytrichum commune (Br.).

FILICALES : Adiantum Capillus-Veneris (T ; R) ; Asplenium Ruta-muraria (M ; OS, Capillus veneris ; Br.) ; A. viride* ; Botrychium Lunaria* ; Dryopteris Filix-mas (T ; R) ; Ophioglossum vulgatum (P) ; Phyllitis Scolopendrium (T ; R ; OS, Scolopendria ; Br.) ; Polypodium vulgare (T ; R ; OS ; Br.) ; Pteridium aquilinum (T ; R).

EQUISETALES : Equisetum arvense var. decumbens* ; E. palustre*.

GYMNOSPERMÆ : Juniperus communis (T ; M ; OS ; Br.) ; J. Sabina (D) ; Larix decidua (R).

TYPHACEÆ : Typha latifolia (V ; D).

POTAMOGETONACEÆ : Potamogeton natans (D).

ALISMACEÆ : Alisma Plantago-aquatica (AEL ; D ; Br.).

GRAMINEÆ : Avena sativa (T ; R ; OS ; Br.) ; Hordeum distichon (T ; R) ; H. tetrastichum (T) ; Panicum miliaceum (AEL ; T ; R ; Br.) ; Secale cereale var. hybernum (sp., P ; Br.) ; Setaria italica (T ; R) ; Sorghum vulgare (AEL ; R ; M) ; Triticum monococcum (T) ; T. Spelta (AEL ; R ; Br.) ; T. turgidum* ; T. vulgare (AES, 1884 ; T) ; Zea Mays (Tragus, 1539, Welsch Korn).

CYPERACEÆ : Cyperus longus (AET ; T).

ARACEÆ : Arum maculatum (A ; OS, Aarona ; Br.) ; Calla palustris* ; Dracunculus vulgaris (T ; R ; Br.).

LILIACEÆ : Allium Cepa (AEL ; T ; R ; Br.) ; A. oleraceum* ; A. Porrum (AEL ; T ; M ; OS, Porrum ; Br.) ; A. sativum (AES, 1887 ; T ; R ; Br.) ; A. Schœnoprasum* ; A. ursinum (Br.) ; A. vineale* ; Aloë vera (M) ; Asparagus officinalis var. altilis (C ; OS, Sparagus ; Br.) ; Colchicum autumnale (D ; Br.) ; Convallaria majalis (OS, Lilium convallium ; Br.) ; Gagea lutea* ; Lilium candidum (T ; R ; OS ; Br.) ; L. croceum (Br.) ; L. Martagon (T ; M ; Br.) ; Muscari comosum (T ; R) ; M. botryoides* ; Paris quadrifolia* ; Polygonatum multiflorum (Br.) ; P. verticillatum (? D) ; Ruscus Hypoglossum (T ; D ; Br.) ; Scilla bifolia (T ; Br.) ; Smilax aspera (T ; R) ; Urginea maritima (N ; V ; C ; D) ; Veratrum album (T ; R).

AMARYLLIDACEÆ : Leucojum vernum (Br.).

IRIDACEÆ : Crocus sativus var. officinalis (T ; R) ; Iris fœtidissima (T ; OS, Spatula fetida) ; I. germanica (D ; Br.) ; I. Pseudacorus (R ; OS, Acorus ; Br.).

ORCHIDACEÆ : Anacamptis pyramidalis (D ; M) ; Gymnadenia conopsea (Br.) ; Habenaria bifolia* ; Listera ovata (Br.) ; Ophrys apifera* ; Orchis maculata* ; O. mascula* ; O. militaris (Br.) ; O. Morio (D ; Br.) ; O. ustulata*.

SALICACEÆ : Salix purpurea (R) ; S. repens var. rosmarinifolia* ; S. vitellina (V ; C).

JUGLANDACEÆ : Juglans regia (T ; R).

BETULACEÆ : Corylus Avellana (T ; R ; OS) ; C. maxima (T ; RD).

FAGACEÆ : Castanea sativa (T ; R) ; Quercus Robur (Q. pedunculata) (T ; R ; OS, Arbor glandis).

MORACEÆ : Cannabis sativa (C ; D ; OS, Canapus ; Br.) ; Ficus Carica (AES, 1884 ; T ; R ; OS) ; Humulus Lupulus (P ; OS ; Br.) ; Morus nigra (T ; R ; OS).

URTICACEÆ : Parietaria officinalis (D ; OS ; Br.) ; Urtica dioica (D ; OS ; Br.) ; U. pilulifera (R) ; U. urens (T ; Br.).

LORANTHACEÆ : Viscum album (T ; M).

ARISTOLOCHIACEÆ : Aristolochia Clematitis (D ; OS ; Br.) ; Asarum europæum (D ; M ; OS, Azarum, Vulgago ; Br.).

POLYGONACEÆ : Polygonum aviculare (C ; D) , P. Bistorta (OS, Colubrina ; Br.) ; P. Hydropiper (D ; M) ; P. lapathifolium (Br.) ; Rumex Acetosa (C ; D ; M ; OS, Acetosa ; Br.) ; R. alpinus* ; R. obtusifolius (D ; M ; Br.).

CHENOPODIACEÆ : Atriplex hortensis (C ; D) ; Beta vulgaris var. Cicla (C ; Br.) ; B. vulgaris var. crassa* ; B. vulgaris var. cruenta (B ; Br.) ; Chenopodium album* ; C. Bonus-Henricus (Br.) ; C. Botrys (D) ; C. polyspermum* ; C. rubrum* ; Spinacia oleracea (M ; OS).

AMARANTHACEÆ : Celosia cristata (P).

PORTULACACEÆ : Portulaca oleracea (AEL ; T ; R ; OS).

CARYOPHYLLACEÆ : Agrostemma Githago (D ; OS, Nigella ; Br.) ; Arenaria serpyllifolia* ; Dianthus carthusianorum (Br.) ; D. Caryophyllus (M) ; D. superbus* ; Saponaria officinalis (T ; R) ; Stellaria Holostea* ; S. media (Br.).

NYMPHÆACEÆ : Nuphar luteum (T ; M ; OS, Nenuphar ; Br.) ; Nymphæa alba (T ; R ; Br.).

RANUNCULACEÆ : Aconitum lycoctonum (D) ; Anemone nemorosa (Br.) ; A. Pulsatilla (Br.) ; A. ranunculoides* ; Aquilegia vulgaris (M ; OS, Egilops) ; Clematis Vitalba (T ; D) ; Delphinium Consolida (OS, Consolida regalis ; Br.) ; D. Staphisagria (T ; R) ; Helleborus fœtidus (C ; D) ; H. viridis (M ; Br.) ; Nigella arvensis* ; N. damascena (M) ; N. sativa (N ; D) ; Pæonia peregrina* ; Ranunculus acris var. flore pleno (Br.) ; R. arvensis* ; R. auricomus* ; R. bulbosus (Br.) ; R. Ficaria (T ; Br.) ; R. repens var. suberectus* ; R. sceleratus*.

BERBERIDACEÆ: Berberis vulgaris (P; M; OS; Br.).

PAPAVERACEÆ: Chelidonium majus (T; R; OS, Celidonia, Flores Sancti Johannis; Br.); Corydalis cava (OS, Aristologia rotunda; Br.); Fumaria officinalis (R; Br.); Glaucium flavum (T; R; N; D); Papaver Rhœas (AEL; T; M; Br.); P. somniferum (T; R; OS; Br.).

CRUCIFERÆ: Alliaria officinalis*; Barbarea vulgaris*; Brassica campestris, var. Rapa (T; Br.), subvar. depressa and subvar. oblonga; B. Napus (C; Br.); B. Napus var. Napobrassica*; B. oleracea var. acephala, subvar. sabellica*, and subvar. viridis*; B. oleracea var. capitata (C; M; Br.); Capsella Bursa-pastoris (CV, 141, recto; M; OS, Bursa pastoris; Br.); Cardamine pratensis (Br.); Cheiranthus Cheiri (T; R; Br.); Cochlearia Armoracia (C; D; OS, Raffanus (merreuch); Br.); Diplotaxis tenuifolia*; Eruca sativa (T; R); Hesperis matronalis var. hortensis, subvars. albiflora and purpurea (sp., Ov.); Isatis tinctoria var. sativa and var. vulgaris (sp., D; P); Lepidium campestre:* L. latifolium (D; Br.); L. ruderale (Br.); L. sativum (T; Br.); Matthiola incana (T; R; Br.); Nasturtium officinale (C; D; OS); Raphanus sativus (AEL; T; R; OS, Raffanus (reuch); Br.); Rorippa sylvestris*; Sinapis alba (N; C; Br.); S. arvensis (AEL; D; Br.); Sisymbrium officinale (N; Br.); S. Sophia (Br.).

CRASSULACEÆ: Sedum acre (D; Br.); S. album (M; Br.); S. roseum (N; D); S. rupestre*; S. Telephium var. album and var. purpureum (sp., A; OS, Vermicularis; Br.); Sempervivum tectorum (T; M; OS, Barba iovis; Br.).

SAXIFRAGACEÆ: Ribes rubrum*; R. Uva-crispa*; Saxifraga granulata (Br.).

ROSACEÆ: Agrimonia Eupatoria (D; OS; Br.); Alchemilla vulgaris (M; OS; Br.); Aruncus sylvester*; Cydonia oblonga (T); Filipendula hexapetala (T); Fragaria vesca (P; OS, Frage; Br.); F. moschata*; Geum intermedium×G. urbanum*; G. urbanum (P; OS, Gariofilata; Br.); Potentilla alba*; P. Anserina (OS, Protentilla; Br.); P. erecta (M; OS, Tormentilla; Br.); P. reptans (T; R; OS, Pentafilon; Br.); Poterium Sanguisorba (M); Prunus avium (T; R); P. domestica (T; R); P. Persica (C; D); P. spinosa (R; OS, Accacia; Br.); Rosa canina (T; C); R. gallica (P; OS); Rubus fruticosus (D; OS, Morabacci; Br.); Sanguisorba officinalis (N; D); Sorbus domestica (T; R).

LEGUMINOSÆ: Cassia obovata (ART); Cicer arietinum (T; R; OS, Citrullus; Br.); Colutea arborescens (T); Genista germanica*; G. tinctoria (R); Glycyrrhiza glabra (T; M; OS; Br.); Lathyrus sativus (AES, 1887; T; R); L. sylvestris*; L. tuberosus (T; R); Lens culinaris (AES, 1884; T; R; OS; Br.); Lotus corniculatus (V); Lupinus albus (T; R; OS); Medicago lupulina (Br.); Melilotus dentata*; Ononis spinosa (R); Phaseolus vulgaris*; Pisum sativum (T; R; OS; Br.); Sarothamnus scoparius (Br.); Spartium junceum (T; R); Trifolium arvense (D); T. montanum*; T.

pratense (M; Br.); Trigonella cærulea*; T. corniculata*; T. Fœnum-græcum (T; R; OS, Fenugrecum); Vicia Faba (AES, 1884; T; R; OS, Faba; Br.); V. sativa (AEL; C; OS, Orobus; Br.); V. sepium*.

SAPINDACEÆ: Cardiospermum Halicacabum*.

GERANIACEÆ: Erodium cicutarium (Br.); Geranium dissectum (M); G. pratense*; G. Robertianum (OS, Herbea rubea); G. rotundifolium?; G. sanguineum (OS, Dens leonis).

OXALIDACEÆ: Oxalis Acetosella (OS, Alleluia; Br.).

LINACEÆ: Linum usitatissimum (T; R; OS; Br.).

RUTACEÆ: Ruta graveolens (T; R; OS; Br.).

EUPHORBIACEÆ: Euphorbia Cyparissias (N; D); E. Helioscopia (D; Br.); E. Lathyris (D; OS, Titimallus; Br.); E. Peplus (T); E. platyphyllos (R); Mercurialis annua (D; OS); M. perennis (T); Ricinus communis (T; R; Br.).

BUXACEÆ: Buxus sempervirens var. arborescens (T; R; OS).

BALSAMINACEÆ: Impatiens Balsamina*.

VITACEÆ: Vitis vinifera (AES, 1884; T; R; OS, Passule, Vitis; Br.).

MALVACEÆ: Althæa officinalis (T; R; OS; Br.); A. rosea (D); Gossypium herbaceum (AR; ME); Malva Alcea (Br.); M. rotundifolia (R; Br.); M. sylvestris (T; R; Br.).

GUTTIFERÆ: Hypericum hirsutum*; H. montanum*; H. perforatum (D; OS, Ypericon; Br.).

TAMARICACEÆ: Myricaria germanica*.

VIOLACEÆ: Viola odorata (T; R; Br.); V. tricolor (R; OS, Yacea; Br.).

THYMELÆACEÆ: Daphne Mezereum*.

ONAGRACEÆ: Epilobium hirsutum (R).

ARALIACEÆ: Hedera Helix (T; R; OS, Edera; Br.).

UMBELLIFERÆ: Ammi majus (M); A. Visnaga (6th century—*vide* Sprague in Journ. Bot. 1922, 213); Anethum graveolens (AEL; T; R, OS); Angelica sylvestris*; Anthriscus Cerefolium (C; OS, Cerifolium); A. sylvestris*; Apium graveolens (AES, 1887; T; R; Br.); Archangelica officinalis (M; Br.); Astrantia major*; Bupleurum rotundifolium (R; OS, Durchwachs; Br.); Carum Carvi (N; C; D); Conium maculatum (T; R); Coriandrum sativum (AEL; T; R; Br.); Daucus Carota (T; R; OS, Pastinaca domestica; Br.); Eryngium campestre (T; N); Fœniculum vulgare (T; R; Br.); Heracleum Sphondylium (D; M; OS, Branca ursina; Br.); Laserpitium latifolium*; Levisticum officinale (C; D; OS; Br.); Meum athamanticum (A; Br.); Pastinaca sativa (N; C; D); Petroselinum hortense (T; R; OS; Br.); Peucedanum Cervaria*; P. officinale (T; M); P. Ostruthium (OS, Astrens; Br.); Pimpinella Anisum (T; R; Br.); P. major*; Sanicula europæa (M; OS, Diapensia; Br.); Sison Amomum*; Sium angustifolium (D); S. Sisarum (C; Br.); Smyrnium Olusatrum (T; R).

PYROLACEÆ: Pyrola rotundifolia (OS; Br.).

Ericaceæ: Calluna vulgaris (OS, Mirica; HB, Heid).

Primulaceæ: Anagallis arvensis (D; Br.); A. fœmina (T; Br.); Cyclamen europæum (N; M); Lysimachia Nummularia*; L. vulgaris (D); Primula elatior (Br.); P. veris (OS, Herba paralisis; Br.).

Oleaceæ: Ligustrum vulgare (T; R).

Gentianaceæ: Centaurium umbellatum (T; M; Br.); Gentiana cruciata (Br.); G. lutea (D; M).

Apocynaceæ: Nerium Oleander (T; R); Vinca minor (D; Br.).

Asclepiadaceæ: Vincetoxicum officinale (D; Br.).

Convolvulaceæ: Calystegia sepium (T; R; OS, Volubilis media; Br.); Convolvulus arvensis (D); Cuscuta Epilinum (R).

Boraginaceæ: Anchusa azurea (A. italica) (N); A. officinalis (M; OS, Buglossa; Br.); Borago officinalis (M; OS; Br.); Echium vulgare (M; Br.); Lithospermum arvense*; L. officinale (D; M); Lycopsis arvensis*; Symphytum officinale (D; OS, Consolida maior; Br.).

Verbenaceæ: Verbena officinalis (D; OS; Br.).

Labiatæ: Ajuga Chamæpitys (N; D); A. reptans (M); Ballota nigra*; Glechoma hederacea (M; OS, Edera terrestris; Br.); Hyssopus officinalis (D; Br.); Lamium album (D; Br.); Lavandula officinalis (M); L. Spica (T.); L. Stœchas (D; OS, Sticados arabicum); Leonurus Cardiaca (M; OS, Cardiaca; Br.); Marrubium vulgare (C; D; OS; Br.); Melissa officinalis (T; M; Br.); Melittis Melissophyllum (OS, Melissa); Mentha aquatica (T; M); M. arvensis*; M. gentilis (D); M. Pulegium (T; R; Br.); M. rotundifolia*; M. sativa (T; V; D); M. sylvestris (N; C; D); M. viridis (T); Nepeta Cataria (C; M); Ocimum Basilicum (T; R; Br.); Origanum Majorana (T; OS, Majorana; Br.); O. vulgare (C; M; OS; Br.); Prunella vulgaris (M; OS, Brunella); Rosmarinus officinalis (AEL; C; D; OS, Anthos; Br.); Salvia officinalis (N; Br.); S. pratensis (M; Br.); S. Sclarea*; Satureja Acinos (D); S. hortensis (C; OS); Stachys germanica (M); S. officinalis (A; OS, Betonica; Br.); S. recta*; Teucrium Botrys*; T. Chamædrys (T; D); T. flavum (D); T. Scordium (D); Thymus Serpyllum (C; D; Br.); T. vulgaris (C; Br.).

Solanaceæ: Atropa Belladonna (T; M; Br.); Capsicum annuum*; C. cordiforme*; C. longum*; Datura Metel (AR); Hyoscyamus niger var. pallidus* (sp., R; OS, Jusquiamus; Br.); Mandragora officinarum (T; B; AR); Physalis Alkekengi (D; M; OS, Alkekengi; Br.); Solanum Melongena (AR; M); S. nigrum (T; M; OS, Solatrum; Br.).

Scrophulariaceæ: Digitalis ambigua*; D. purpurea*; Euphrasia officinalis (OS, Eufragia; Br.); Linaria spuria (D); L. vulgaris (A; OS; Br.); Scrophularia aquatica*; Verbascum Blattaria*; V. Lychnitis var. album* (sp., D); V. nigrum*; V. phlomoides (R); V. Thapsus (D; Br.); Veronica agrestis*; V. Beccabunga (M; Br.); V. Chamædrys (OS, Gamandria; Br.); V. hederifolia*; V. officinalis*; V. Teucrium (Br.).

Acanthaceæ: Acanthus mollis (N; V; C; PD).

PLANTAGINACEÆ: Plantago Coronopus (T; D); P. lanceolata (T; M; OS, Plantago minor; Br.); P. major (T; R; OS, Plantago maior; Br.); P. media*; P. Psyllium (D).

RUBIACEÆ: Galium Aparine (T; V; D; R); G. Mollugo*; G. verum (D; M); Rubia tinctorum (D).

CAPRIFOLIACEÆ: Lonicera Periclymenum (R); Sambucus Ebulus (C; D; Br.); S. nigra (T; D; OS; Br.).

VALERIANACEÆ: Valeriana officinalis var. latifolia* (sp., OS; Br.); V. Phu*.

DIPSACACEÆ: Dipsacus fullonum (D; M; OS, Virga pastoris); D. sylvestris (R; OS, Cardo; Br.); Knautia arvensis (M); Succisa pratensis (M; OS, Morsus diaboli; Br.).

CUCURBITACEÆ: Bryonia alba (N; C; D); Citrullus Colocynthis (M); C. vulgaris (AES, 1884; R); Cucumis Melo var. Cantalupo (sp., R); C. sativus (T; R); Cucurbita Pepo (R); Ecballium Elaterium (T; N; D; M); Lagenaria vulgaris (AES, 1884; T; R; OS, Cucurbita; Br.); Momordica Balsamina (AEL; M).

CAMPANULACEÆ: Campanula Rapunculus (M; Br.); C. Trachelium*.

COMPOSITÆ: Achillea Millefolium (M; OS, Millefolium; Br.); A. Ptarmica (D; OS, Piritrum; Br.); Anacyclus Pyrethrum (N; D); Antennaria dioica*; Anthemis Cotula (A; M; Br.); A. tinctoria (D); Arctium Lappa (D; OS, Lappacium and L. rotundum); Artemisia Abrotanum (D; Br.); A. Absinthium (T; R; Br.); A. pontica (D; M); A. vulgaris (B; M; OS, Arthemisia; Br.); Aster Amellus (T; V; C); Bellis perennis (P; OS, Premula veris; Br.); B. perennis var. hortensis*; Calendula officinalis (C; P; OS, Caput monachi; Br.); Carlina acaulis (Br.); C. vulgaris (Br.); Carthamus tinctorius (AES, 1884; T; M; Br.); Centaurea Cyanus (R; OS, Flores frumentorum; Br.); Chrysanthemum Leucanthemum (Br.); C. Parthenium (T; R; OS, Febrifuga; Br.); Cichorium Endivia (V; C; D); C. Intybus (T; R; OS, Cicorea; Br.); Cnicus benedictus (T); Crepis tectorum*; Cynara Scolymus (T; R); Echinops sphærocephalus*; Eupatorium cannabinum (M); Filago germanica (M); Helichrysum arenarium*; Hieracium Pilosella (OS; Br.); Inula Helenium (T; R; Br.); Lactuca sativa (T; R); L. sativa var. crispa*; L. Scariola (T; D); Matricaria Chamomilla (T; R; OS, Camomilla; Br.); M. inodora*; Onopordon Acanthium (D; M; Br.); Petasites hybridus (D); Pulicaria dysenterica (M); Santolina Chamæcyparissus (D); Senecio Fuchsii*; S. Jacobæa (M; Br.); S. vulgaris (T; D; R; Br.); Silybum Marianum (T; OS, Yringus; Br.); Sonchus arvensis*; S. asper (R); S. oleraceus (D; R; OS, Ferula); Tagetes patula*; Tanacetum vulgare (M; OS, Tanacetum, Tamarindus; Br.); Taraxacum officinale (T; M; Br.); Tragopogon pratensis (M); Tussilago Farfara (D; OS, Appollinaria; Br.); Xanthium strumarium (D; OS, Lappa minor; Br.).

12. *Identification of the Figures.*

In view of the historic importance of Fuchs's herbal, it is somewhat surprising that no adequate botanical account of it has been published previously. A complete list of identifications of the figures was given by Salomon Schinz, in 1778, as an appendix to his 'Anleitung zu der Pflanzenkenntnisz.' This was very well done for the period, though it contains, as might be expected, a moderate proportion (about 5 per cent.) of erroneous determinations, as well as various others which are incomplete. Owing to the list being hidden away in a relatively ephemeral Introduction to Botany, it has been almost entirely overlooked by subsequent authors. Sprengel evidently did not know of its existence: his list of the species figured included less than 300 of the 517 illustrations, and about 40 (13 per cent.) of his identifications are erroneous, among the more striking examples being "*Blitum virgatum*" (*Chenopodium polyspermum*), "*Convolvulus arvensis*" (*Calystegia sepium*), and "*Polygonum Convolvulus*" (*Convolvulus arvensis*). Greene's chapter on Fuchs in his "Landmarks of Botanical History," gives perhaps the best general idea of the nature of the work and is very interesting and suggestive, but is based on insufficient investigation, and is inaccurate in matters of detail †. His sections on "Vegetative Organography," "Inflorescence," and "Anthology" repay study. The accounts given by Roth (1899) and Stübler (1928) are biographical and bibliographical, rather than botanical. As an introduction to the subject, Arber's 'Herbals' is excellent.

In the following enumeration a special running number has been assigned to each figure. This is succeeded by the Latin and German names used by Fuchs and by references to his 'Historia' (1542), 'New Kreüterbuoch' (1543) and 'Vivæ Imagines' (1545). Where the species was figured by Brunfels, a reference to that author is inserted, the Arabic figures indicating the running number adopted by Sprague (1928). Then follow the names used by Caspar Bauhin and Linné, the now accepted name being added where it is different from the Linnean. Where a species is still employed medicinally according to Potter's 'Cyclopædia of Drugs' or Leclerc's 'Phytothérapie,' the relevant pages of those works are cited. The habitats given in the 'Historia' and 'New Kreüterbuoch' are added.

As it is sometimes difficult to trace the origin of the generic names (chapter-headings) used by Fuchs, references to these are supplied in all cases. The chapter-numbers are those of the 'Historia,' the number in the 'New Kreüterbuoch' being added in brackets, wherever it is different. The sequence of figures is that of the 'Historia,' the six additional figures appearing in the 'New Kreüterbuoch,' 'Den Nieuwen Herbarius' and 'Vivæ Imagines' being given in an appendix. The figures in the last three works follow the same general sequence as in the 'Historia': where they have been transposed to another part of the work, they may be found by means of the Index of Latin and German names (p. 637).

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† The following slips may be noted: Greene, p. 200, the definition of "stipulæ" was not original, but borrowed from Isidorus; p. 209, *Solanum Melongena* is *not* associated with *S. nigrum* and *Atropa Belladonna*; p. 210, Fuchs's two species of *Verbena* are *V. officinalis* and *Sisymbrium officinale*; p. 212, *Absinthium Seriphium* Fuchs is *Sisymbrium Sophia*; p. 216, *Acorus officinarum* and *Tagetes indica* are *not* generic names; p. 218, *Ocimastrum* is *not* new in Fuchs.

The following abbreviations have been adopted:—N.K., New Kreüterbuoch; N.H., Den Nieuwen Herbarius; Im., Vivæ Imagines; Br, Brunfels; C.B.P., Caspar Bauhin, Pinax; L. Sp., Linn. Sp. Pl. ed. 1; P.C., Potter's Cyclopædia of Drugs; L.P., Leclerc, Phytothérapie. Arabic numerals without preceding letters indicate the pages of the 'Historia.'

It may be noted that pp. 34–59 of the 'Historia' are erroneously numbered 35–60: the actual printed page-number of a figure has been cited in each of these cases, in order to avoid confusion. Isolated pages which happen to be wrongly numbered (e.g., 473 as "476," 476 as "473," 588 as "488") are, however, cited under their correct numbers.

Cap. I: ABSINTHIUM Diosc. III, xxiii (xxvi), xxiv (xxvii).

1. *Absinthium vulgare*, Wermuot, 1; N.K. t. i; Im. 2.—Br. 193. *Absinthium Ponticum, seu Romanum officinarum, seu Dioscoridis* C.B.P. 138. *Artemisia Absinthium* L. Sp 848; P.C. 308; L.P. 31, 127.—Habitat avowedly taken from Oribasius and Apuleius.

2. *Seriphium Absinthium*, Welsomen, Welsamen, 2; N.K. t. ii. *Nasturtium sylvestre*, Im. 205.—Br. 203. *Nasturtium sylvestre tenuissime divisum* C.B.P. 105. *Sisymbrium Sophia* L. Sp. 659.—"By waysides, vineyard walls, and hedge-rows in Germany."

Cap. II: ABROTONUM Diosc. III, xxvi (xxix).

3. *Abrotonum mas*, Stabwurtz mennle, Staubwurtz, 6; N.K. t. iii; Im. 4.—Br. 267. *Abrotanum mas angustifolium majus* C.B.P. 136. *Artemisia Abrotanum* L. Sp. 845; Spreng. Gesch. Bot. i. 268; P.C. 265.—"Grown in gardens in Germany."

4. *Abrotonum fœmina*, Stabwurtz weible, 7; N.K. t. iv; *Absinthium Ponticum*, Im. 3.—*Absinthium Ponticum tenuifolium incanum* C.B.P. 138. *Artemisia pontica* L. Sp. 847; Spreng. Gesch. Bot. i. 268.—"On hills, and about mountains, and on sandy roads."

Cap. III: ASARUM Diosc. I, ix.

5. *Asarum*, Haselwurtz, 10; N.K. t. v; Im. 5.—Br. 17. *Asarum* C.B.P. 197. *Asarum europæum* L. Sp. 442; P.C. 15; L.P. 20.—"Likes rough and dry soil, but is sometimes found in moist woods in stiff soil."

Cap. IV: ACORUM Diosc. I, ii.

6. *Acorum officinarum*, Drachenwurtz, 12; N.K. t. vi. *Gladiolus luteus*, Im. 6.—Br. 113. *Acorus adulterinus* C.B.P. 34. *Iris Pseudacorus* L. Sp. 38; P.C. 310; L.P. 22.—"By stream-banks and ponds, and in damp meadows."

Cap. V: ALTHÆA Diosc. III, cliii (clxiii).

7. *Althæa*, Eibisch, 15; N.K. t. vii; Im. 7.—Br. 186. *Althæa Dioscoridis et Plinii* C.B.P. 315. *Althæa officinalis* L. Sp. 686; P.C. 182; L.P. 191.—"Prefers moist rich land, as in water-meadows near ditches. Also planted in almost all gardens."

Cap. VI: ANAGALLIS Diosc. II, ccix.

8. *Anagallis mas*, Gauchheyl mennle, 18; N.K. t. viii; Im. 8.—Br. 83. *Anagallis phœniceo flore* C.B.P. 252. *Anagallis arvensis* L. Sp. 148; P.C. 216.—"In vineyards and fields, and especially among stubble."

9. *Anagallis fœmina*, Gauchheyl weible, 19; N.K. t. ix; Im. 9.—Br. 84. *Anagallis cœruleo flore* C.B.P. 252. *Anagallis fœmina* Mill. Gard. Dict. ed. 8, no. 2.—Same habitat as No. 8.

Cap. VII: ALSINE Diosc. II, ccxiv; Plin. XXVII, iv. 8.

10. *Alsine maior*, Huenerderm, 21; N.K. t. x. *Alsines primum genus*, Im. 10.—Br. 234. *Alsine media* C.B.P. 250. *Alsine media* L. Sp. 272. *Stellaria media* Vill.; P.C. 68.—"All the year round in gardens, vineyards, woods, and rich fields."

11. *Alsine media*, Huenerserb, 22; N.K. t. xi. *Alsines alterum genus*, Im. 11.—*Alsine Chamædrifolia flosculis pediculis oblongis insidentibus* C.B.P. 250. *Veronica agrestis* L. Sp. 13.—Same habitat as No. 10.

12. *Alsine minor*, Kleinvogelkraut, 23; N.K. t. xii. *Alsines tertium genus*, Im. 12.—*Alsine minor multicaulis* C.B.P. 250. *Arenaria serpyllifolia* L. Sp. 423.—Same habitat as No. 10.

Cap. VIII: ANTHEMIS Diosc. III, cxliv (cliv).

13. *Chamæmelon leucanthemum*, Camillen, 25; N.K. t. xiii; Im. 14.—Br. 232. *Chamæmelum vulgare, Leucanthemum Dioscoridis* C.B.P. 135. *Matricaria Chamomilla* L. Sp. 891; Spreng. Gesch. Bot. i. 268; P.C. 65; L.P. 170.—"In cornfields, and in hard dry poor soil by waysides."

14. *Chamæmelum chrysanthemum*, Gel Camillen, 26; N.K. t. xiv; Im. 15.—*Anthemis tinctoria* L. Sp. 896; Spreng. Gesch. Bot. i. 268.—"In hard dry soil by waysides. Is called Streichbluom because the women collect it for stroking and strengthening their bedding."

15. *Chamæmelum eranthemon*, Rittersporn, 27; N.K. t. xv. *Consolida regia*, Im. 239.—Br. 21. *Consolida regalis arvensis* C.B.P. 142. *Delphinium Consolida* L. Sp. 530; P.C. 160.—Same habitat as No. 13.

Cap. IX: ANETHUM Diosc. III, lx. (lxvii).

16. *Anethum*, Dyll, 30; N.K. t. xvi; Im. 16.—*Anethum hortense* C.B.P. 147. *Anethum graveolens* L. Sp. 263; P.C. 92; L.P. 139.—"Planted everywhere in gardens. Also occurs spontaneously, like Fennel."

Cap. X : AIZOON Diosc. IV, lxxxviii (lxxxix).

17. *Sedum maius*, Gross Hauszwurtz, 32 ; N.K. t. xviii ; Im. 17.—Br. 273. *Sedum majus vulgare* C.B.P. 283. *Sempervivum tectorum* L. Sp. 464 ; P.C. 139 ; L.P. 218.—" On houses, old walls, roofs, and high mountains."

18. *Sedum minus mas*, Klein Hauszwurtz mennle, 33 ; N.K. t. xviii ; Im. 18.—*Sedum minus luteum folio acuto* C.B.P. 283. *Sedum rupestre*, var. β, L. Sp. 431 ; Praeger in Journ. Hort. Soc. xlvi. 265, fig. 156.—" On walls and old roofs, high woods, and hot sandy fields and heaths."

19. *Sedum minus fœmina*, Klein Hauszwurtz weible, 35 ; N.K. t. xix ; Im. 19.—Br. 242. *Sedum minus teretifolium album* C.B.P. 283. *Sedum album* L. Sp. 432 ; Praeger, l. c. 182, fig. 102.—Habitat as in No. 18.

20. *Sedi tertium genus*, Katzentreuble, 36 ; N.K. t. xx ; Im. 20.—Br. 241. *Sempervivum minus vermiculatum acre* C.B.P. 283. *Sedum acre* L. Sp. 432 ; Praeger, l. c. 246, fig. 143 ; L.P. 218.—" In stony places, shady sepulchres, and by the moats of towns " (" shady sepulchres " copied from Dioscorides).

Cap. XI : ARNOGLOSSUM Diosc. II, clii. (cliii).

21. *Plantago maior*, Breyt Wegrich, Rot Wegerich, 38 ; N.K. t. xxi ; Im. 21.—Br. 4. *Plantago latifolia sinuata* C.B P. 189. *Plantago major* L. Sp. 112 ; P.C. 221 ; L.P. 218.—" Prefers moist situations."

22. *Plantago minor*, Spitziger Wegrich, 39. Breyter Wegrich, N.K. t. xxii. *Plantago media*, Im. 22.—Br. 2. *Plantago angustifolia major* C.B.P. 189. *Plantago lanceolata* L. Sp. 113 (leaves) and *P. media* L. l. c. (scapes).—A composite figure, the leaves having apparently been adapted from Brunfels's figure of " *Plantago minor* " (*P. lanceolata* L.), whereas the scapes seem to have been drawn from specimens of *P. media* L.—" Leaves spread out on the ground like a star, rough and hairy, with seven plicate nerves, tongue-like. Peduncles terete, hairy, about a span long, bearing at the apex a spike of white and purple sweet-smelling flowers." This description, added in the New Kreüterbuoch, is mainly copied from Bock's New Kreütter Buoch, fol. lxi, verso (1539), and applies exclusively to *Plantago media*.—" In moist places, also on balks of fields, and in gardens and meadows."

Cap. XII : ALISMA Diosc. III, clix (clxix).

23. *Plantago-aquatica* (*Alisma*, *Damasonium*), Wasser Wegrich, 42 ; N.K. t. xxiii ; Im. 24.—Br. 3. *Plantago aquatica latifolia* C.B.P. 190. *Alisma Plantago-aquatica* L. Sp. 342 ; P.C. 297.—" Everywhere in lakes, pools, swamps, and ditches."

Cap. XIII : ARTEMISIA Diosc. III, cxvii (cxxvii), cxviii (cxxviii).

24. *Artemisia latifolia*, Beifuosz, 44 ; N.K. t. xxiv ; Im. 25.—Br. 139. *Artemisia vulgaris major* C.B.P. 137. *Artemisia vulgaris* L. Sp. 848 ; P.C. 192 ; L.P. 177.—" Leaves resembling those of Wormwood (No. 1), but larger and

fatter, deep green above and white beneath."—"In watered uncultivated rough places."

25. *Artemisia tenuifolia* (*Matricaria*), Mettram, 45; N.K. t. xxv. *Artemisiæ ramosæ altera species*, Im. 26.—Br. 86. *Matricaria vulgaris* C.B.P. 133. *Matricaria Parthenium* L. Sp. 890. *Chrysanthemum Parthenium* Bernh.; P.C. 104.—"Flowers like those of Chamomile (No. 13), with a yellow centre and a ring of little white petals, but smaller and more delicate."—"In gardens, and in dry and stony places, by walls and fences."

26. *Artemisia monoclonos* (*Tanacetum, Tagetes*), Reinfarn, 46; N.K. t. xxvi. *Artemisia tenuifolia* Im. 27.—Br. 87. *Tanacetum vulgare luteum* C.B.P. 132. *Tanacetum vulgare* L. Sp. 844; P.C. 279; L.P. 29.—"Also called Wurmkraut in German, because it kills and expels intestinal worms."—"On the banks of streams, in vineyards, and on the balks of fields (Reinen), hence its German name 'Reinfarn.'"

27. *Tagetes indica*, Indianische Negelen, 47; N.K. t. xxvii. *Flos Indianus, sive Viola flammea*, Im. 28.—*Tanacetum africanum, seu flos africanus minor* C.B.P. 133. *Tagetes patula* L. Sp. 887.—"A lovely flower grown nearly everywhere in gardens and as a pot-plant. A recent introduction, quite unknown formerly."

Cap. XIV: APARINE Diosc. III, xciv (civ).

28. *Aparine* Klebkraut, 50; N.K. t. xxviii; Im. 29.—*Aparine vulgaris* C.B.P. 334. *Galium Aparine* L. Sp. 108; P.C. 71.—"In corn and flax-fields, in gardens, and by fences and hedges."

Cap. XV: ACANTHUS Diosc. III, xvii (xix).

29. *Acanthus vera*, Welsch Bernklaw, 52; N.K. t. xxix; Im. 30.—*Acanthus sativus vel mollis Vergilii* C.B.P. 383. *Acanthus mollis* L. Sp. 639; Sibth. Fl. Græc. t. 610.—Account taken bodily from Dioscorides.

30. *Acanthus germanica*, Teütsch Bernklaw, 53; N.K. t. xxx. *Acanthus vulgaris*, Im. 31.—Br. 206. *Sphondylium vulgare hirsutum* C.B.P. 157. *Heracleum Sphondylium* L. Sp. 249.—"In orchards and sandy meadows."

Cap. XVI: SPINA ALBA Diosc. III, xii (xiv).

31. *Spina-alba hortensis* (*Carduus Mariæ*), Marien Distel, 56; N.K. t. xxxi; Im. 32.—Br. 127. *Carduus albis maculis notatus vulgaris* C.B.P. 381. *Carduus Marianus* L. Sp. 823. *Silybum Marianum* Gaertn.—"Planted in gardens."

32. *Spina-alba sylvestris*, Weisz Wegdistel, 57; N.K. t. xxxii; Im. 33.—Br. 172. *Spina alba tomentosa latifolia sylvestris* C.B.P. 382. *Onopordum Acanthium* L. Sp. 827.—"In uncultivated and sandy places and by fences."

Cap. XVII: ASPARAGUS Diosc. II, cli (clii).

33. *Asparagus*, Spargen, 58; N.K. t. xxxiii. *Asparagus altilis*, Im. 34.—Br. 208. *Asparagus sativa* C.B.P. 489. *Asparagus officinalis* var. *altilis* L.

Sp. 313 ; P.C. 16 ; L.P. 40.—" The druggists knock off one letter and call the plant 'Sparagos.' "—" Cultivated in gardens, and occurs spontaneously in some stony places."

Cap. XVIII : ANONIS Diosc. III, xviii (xxi).

34. *Anonis* (*Resta bovis*, *Remora aratri*), Hawheckel, 60 ; N.K. t. xxxiv ; Im. 35.—*Anonis spinosa flore purpureo* C.B.P. 389. *Ononis spinosa* L. Sp. 716.—" Flowers flesh-coloured red, so like those of the French Bean or Common Pea, that one can hardly tell one from the other."—" In rich clayey cultivated fields."

Cap. XIX : ANISUM Diosc. III, lviii (lxv).

35. *Anisum*, Enisz, 62 ; N.K. t. xxxv ; Im. 36.—Br. 173. *Anisum herbariis* C.B.P. 159. *Pimpinella Anisum* L. Sp. 264 ; P.C. 11 ; L.P. 135. —" A native of Syria, but sown in gardens everywhere in Germany."

Cap. XX : ACTE Diosc. IV, clxxi (clxxiv), clxxii (clxxv).

36. *Sambucus*, Holder, 64 ; N.K. t. xxxvi ; Im. 37.—Br. 244. *Sambucus fructu in umbella nigro* C.B.P. 456. *Sambucus nigra* L. Sp. 269 ; P.C. 96 ; L.P. 57.—" In shady places, and on broken ground, and by water."

37. *Ebulus*, Attich, 65 ; N.K. t. xxxvii ; Im. 38.—Br. 142. *Sambucus humilis sive Ebulus* C.B.P. 456. *Sambucus Ebulus* L. Sp. 269 ; P.C. 95 ; L.P. 58.—Same habitat as No. 36 ; also occurs occasionally in fields.

Cap. XXI : AMMI Diosc. III, lxiii (lxx).

38. *Ammi*, Amey, 67 ; N.K. t. xxxviii ; Im. 39.—*Ammi majus* C.B.P. 159. *Ammi majus* L. Sp. 243.—" Nowhere spontaneous in Germany. Very prolific when sown, and difficult to extirpate."

Cap. XXII : ARUM Diosc. II, cxcvii.

39. *Arum*, Pfaffenpynt, 69 ; N.K. t. xxxix ; Im. 40.—Br. 12. *Arum vulgare non maculatum* C.B.P. 195. *Arum maculatum* L. Sp. 966 ; P.C. 89 ; L.P. 215.—" In woods and hedges, and shady, cold, damp places."

Cap. XXIII : ARCIUM Diosc. IV, cv (cvii).

40. *Personatia* (*Lappa maior*, *Bardana*), Grosz Kletten, 72 ; N.K. t. xl ; Im. 41.—*Lappa major*, *Arcium Dioscoridis* C.B.P. 198. *Arctium Lappa* L. Sp. 816 (*A. majus* Bernh.) ; P.C. 44 ; L.P. 69.—" Behind fences, near borders of fields, in old courtyards and uncultivated places."

Cap. XXIV : ASCYRON Diosc. III, clxii (clxxii).

41. *Ascyrum*, Harthoew, 74 ; N.K. t. xli ; Im. 42.—*Androsœmon hirsutum* C.B.P. 280. *Hypericum hirsutum*, var. β, L. Sp. 786.—" In rough uncultivated places."

Cap. XXV : ANDROSÆMON Diosc. III, clxiii (clxxiii).

42. *Androsæmon*, Kunrath, 76 ; N.K. t. xlii. *Androsæmi species*, Im. 43.—*Ascyrum, sive Hypericum bifolium glabrum non perforatum* C.B.P. 280. *Hypericum montanum* L. Fl. Suec. ed. 2, 266.—" In rough uncultivated places." The vernacular name " Kunrath " belongs, according to Pritzel and Jessen, to *Hypericum perforatum* L.

Cap. XXVI : ARCEUTHOS Diosc. I, ciii.

43. *Iuniperus minor*, Weckholder, 78 ; N.K. t. xliii ; Im. 44.—Br. 259. *Juniperus vulgaris fruticosa* C.B.P. 488. *Juniperus communis* L. Sp. 1040 ; P.C. 152 ; L.P. 56.—" By the sea, and on dry mountains. Does not occur in the plains, nor in cultivated places."—Fuchs also mentions a *Iuniperus maior* of which he figures two fruits. This was apparently only an arborescent form of *J. communis.*

Cap. XXVII : ALCEA Diosc. III, cliv (clxiv).

44. *Alcea,* Sigmarskraut, Sigmarswurtz, 80 ; N.K. t. xliv ; Im. 45.—Br. 133. *Alcea vulgaris major* C.B.P. 316. *Malva Alcea* L. Sp. 689.—" In rich uncultivated fields."

Cap. XXVIII : ADIANTUM Diosc. IV, cxxxiv (cxxxvi).

45. *Adiantum* (*Capillus Veneris*), Frawenhar, 82 ; N.K. t. xlv ; Im. 46.—*Adiantum foliis coriandri* C.B.P. 355. *Adiantum Capillus-Veneris* L. Sp. 1096 ; P.C. 176 ; L.P. 204.—" Does not grow in Germany, as far as I know, but is abundant in the south of France and in Italy."

Cap. XXIX : VITIS VINIFERA Diosc. V, i.

46. *Vitis-vinifera,* Weinreb, 84 ; N.K. t. xlvi ; Im. 47.—Br. 256. *Vitis vinifera* L. Sp. 202 ; L.P. 112.—" Plentiful in Franconia, Würtemberg, the Rhine district, and Alsace."

Cap. XXX : ACONITUM Diosc. IV, lxxvii, lxxviii.

47. *Aconitum pardalianches*, Dolwurtz, 87 ; N.K. t. xlvii ; Im. 48.—*Solanum quadrifolium bacciferum* C.B.P. 167. *Paris quadrifolia* L. Sp. 367.—" A very ancient manuscript herbal depicts this plant as Aconitum. Grows in dense shady woods, and occasionally by hedges on hills. Abundant near the Farrenberg, about a mile from Tübingen."

48. *Aconitum lycoctonon*, Wolffswurtz, 88 ; N.K. xlviii. *Aconitum lycoctonon luteum*, Im. 49. *Aconitum lycoctonum luteum* C.B.P. 183. *Aconitum lycoctonum* L. Sp. 532.—" In wild, deep, mountain valleys and woods."

Cap. XXXI : ARISTOLOCHIA Diosc. III, iv (vi).

49. *Aristolochia rotunda* (*A. longa*), Lang Holwurtz, 90 ; N.K. t. xlix. *Aristolochia longa*, Im. 50.—Br. 11. *Aristolochia Clematitis recta*, C.B.P. 307. *Aristolochia Clematitis* L. Sp. 962 ; L.P. 185.—" In vineyards and hazel woods, and planted in gardens. Flowers yellow, with a rank smell. Fruit pyriform."

—The name "*Aristolochia rotunda*" on the figure is apparently a mistake for "*A. longa.*"

50. *Pistolochia* (*Aristolochia nostra rotunda*), Runde Holwurtz, 91; N.K. t. l. *Aristolochia rotunda vulgaris*, Im. 51.—Br. 9, 10. *Fumaria bulbosa radice cava major* C.B.P. 143. *Fumaria bulbosa* var. *cava* L. Sp. 699. *Corydalis cava* Schweigger et Körte.—"In woods and shady places."

Cap. XXXII: AMPELOS LEUCE Diosc. IV, clxxxi (clxxxiv).

51. *Vitis-alba* (*Psilothrum*, *Bryonia*), Stickwurtz, 94; N.K. t. li; Im. 52.—*Bryonia alba* L. Sp. 1012; P.C. 40.—"Clambering over hedges, fences, walls, and shrubs, attaching itself by tendrils."

Cap. XXXIII: AMPELOS MELÆNA Diosc. IV, clxxxii (clxxxv).

52. *Vitis-nigra*, Lynen, 97; N.K. t. lii; Im. 53.—*Clematis sylvestris latifolia* C.B.P. 300. *Clematis Vitalba*, var. γ, L. Sp. 544.—"Flowers snow-white, sweet-smelling, succeeded by feathery woolly heeds of seeds."—"In thickets and bushy places, creeping over hedges, bushes, and trees."

Cap. XXXIV: AMARANTUS (ELICHRYSUM) Diosc. IV, lvii. AMARANTUS Plin. XXI, viii. 23.

53. *Amarantus luteus* (*Stichas citrina*, *Helichryson*), Reinbluomen, 99; N.K. t. liii; Im. 54.—*Gnaphalium arenarium* L. Sp. 854. *Helichrysum arenarium* Moench.—"In rough dry sandy places, and on arid heaths near water."

54. *Amarantus purpureus*, *Flos amoris*, Sanatbluom, 100; N.K. t. liv; Im. 55.—*Celosia cristata* L. Sp. 205.—"Grown in gardens and as a pot-plant."

Cap. XXXV: AQUILEGIA vulgo *ex* Fuchs.

55. *Aquilegia*, Ackeley, 102; N.K. t. lv. *Aquileia vulgaris*, Im. 56.—*Aquilegia sylvestris* C.B.P. 144. *Aquilegia vulgaris* L. Sp. 533.—"Leaves like those of the Greater Celandine but more rounded in outline. Flowers pendulous, purple reddish or white, double, with five little bells provided with curved tails, almost as in Larkspur. Out of those grow little heads or tubs, with four or five points, as in Love-in-a-mist, with long black seeds inside."—"Commonly planted in gardens. Also occurs in rich meadows and mountain woods, and on rocks and walls."

Cap. XXXVI: ALLIARIA vulgo *ex* Fuchs.

56. *Alliaria*, Knoblochkraut, 104; N.K. t. lvi; Im. 57.—*Alliaria* C.B.P. 110. *Erysimum Alliaria* L. Sp. 660. *Alliaria officinalis* Andrz.—"Leaves like those of the Violet, but larger, and angled when full grown."—"In uncultivated places, near fences and walls, and at the borders of fields."

Cap. XXXVII: ACALYPHE Diosc. IV, xcii (xciv).

57. *Urtica romana*, Welschnessel, 106; N.K. t. lvii; *Urtica vera*, Im. 58.—*Urtica urens pillulas ferens* C.B.P. 232. *Urtica pilulifera* L. Sp. 983.—"In Germany known only as a cultivated plant."

58. *Urtica maior*, Heyternessel, 107 ; N.K. t. lviii ; Im. 59.—Br. 50. *Urtica urens maxima* C.B.P. 232. *Urtica dioica* L. Sp. 984 ; P.C. 197 ; L.P. 107.—" By fences, hedges, and walls."

59. *Urtica minor*, Brennessel, 108 ; N.K. t. lix ; Im. 60.—Br. 53. *Urtica urens minor* C.B.P. 232. *Urtica urens* L. Sp. 984 ; L.P. 107.—" By fences, hedges, and walls."

Cap. XXXVIII : APHACE Diosc. II, clxxvii (clxxxviii).

60. *Aphace* (*Sylvestris vitia, Os mundi*), Wild Wicken, 110 ; N.K. t. lx ; Im. 61.—*Vicia sepium folio rotundiore acuto* C.B.P. 345. *Vicia sepium* L. Sp. 737.—" In fields and hedges."

Cap. XXXIX : ANDRACHNE Diosc. II, cl.

61. *Portulaca hortensis*, Burtzelkraut, Burtzel, 112 ; N.K. t. lxi ; Im. 62.—*Portulaca latifolia, seu sativa* C.B.P. 288. *Portulaca oleracea*, var. *β*, L. Sp. 445. *Portulaca oleracea*, var. *sativa* DC. in DC. Prodr. iii. 353 ; L.P. 34.—" Cultivated in gardens."

62. *Portulaca sylvestris*, Wilde Burtzel, 113 ; N.K. t. lxii ; Im. 63.—*Portulaca angustifolia sive sylvestris* C.B.P. 288. *Portulaca oleracea* L. Sp. 445, var. *sylvestris* DC. l. c.—" On rocks, and in vineyards and rich fields."

Cap. XL : ASPHODELUS Diosc. II, cxcix ; Plin. XXI, xvii. 68.

63. *Asphodelus fœmina*, Goldwurtz weible, 115 ; N.K. t. lxiii. *Lilium purpureum*, Im. 207.—Br. 149. *Lilium floribus reflexis montanum* C.B.P. 77. *Lilium Martagon* L. Sp. 303.—".In mountain woods and high mountain meadows : abundant on the Osterberg at Tübingen."

Cap. XLI : ATRAPHAXIS Diosc. II, cxlv.

64. *Atriplex hortensis*, Molten, 118 ; N.K. t. lxiv ; Im. 64.—*Atriplex hortensis alba sive pallide virens* C.B.P. 119. *Atriplex hortensis* L. Sp. 1053.—" Everywhere cultivated in gardens."

65. *Atriplex sylvestris*, Wild Molten, 119 ; N.K. t. lxv ; Im. 65.—*Atriplex sylvestris altera* C.B.P. 119. *Chenopodium album* L. Sp. 219 ; ed. 2, 319.—" Spontaneous in gardens and elsewhere."

Cap. XLII : ATRACTYLIS Diosc. III, xcvii (cvii) ; Plin. XXI, xv. 53.

66. *Atractylis mitior* (*Cartamus sylvestris*), Wilder Feldsaffran, 121 ; N.K. t. lxvi. *Atractylis vulgaris minor*, Im. 66.—Br. 125. *Cnicus sylvestris spinosior* C.B.P. 378. *Carlina vulgaris* (errore *C. corymbosa*) L. Sp. 828 ; ed. 2, 1161.—" In fields and on mountains."

67. *Atractylis hirsutior* (*Carduus benedictus*), Cardobenedict, 122 ; N.K. t. lxvii ; Im. 67.—*Cnicus sylvestris hirsutior, sive Carduus benedictus* C.B.P. 378. *Cnicus benedictus* L. Sp. 826 ; P.C. 133 ; L.P. 117.—" Now planted everywhere in gardens."

Cap. XLIII : ANGELICA auct. recentior. *ex* Fuchs.

68. *Angelica sativa*, Zam Angelick, 124 ; N.K. t. lxviii ; Im. 68.—Br. 272. *Angelica sativa* C.B.P. 155. *Angelica Archangelica* L. Sp. 250. *Archangelica officinalis* Hoffm. ; P.C. 10 ; L.P. 139.—" Cultivated in gardens, but also occurs spontaneously on certain mountains."

69. *Angelica sylvestris*, Wild Angelick, 125 ; N.K. t. lxix ; Im. 69.—*Angelica sylvestris major* C.B.P. 155. *Angelica sylvestris* L. Sp. 251.—" Occurs in dark and shady places, beside water, and in some woods."

Cap. XLIV : AERA Diosc. II, cxxii.

70. *Lolium*, Ratten, Radten, 127 ; N.K. t. lxx ; Im. 70.—Br. 85. *Lychnis segetum major* C.B.P. 204. *Agrostemma Githago* L. Sp. 435.—" Occurs as a weed among all kinds of corn."

Cap. XLV : ASCLEPIAS Diosc. III, xcvi (cvi).

71. *Asclepias* (*Hirundinaria, Vincetoxicum*), Schwalbenwurtz, 129 ; N.K. t. lxxi ; Im. 71.—Br. 106. *Asclepias albo flore* C.B.P. 303. *Asclepias Vincetoxicum* L. Sp. 216. *Vincetoxicum officinale* Moench ; L.P. 77.—" Occurs on rugged high sandy mountains and in woods. Very abundant on a mountain not far from Tübingen."

Cap. XLVI : APIOS Diosc. IV, clxxiv (clxxvii).

72. *Apios*, Erdnussen, 131 ; N.K. t. lxxii ; Im. 72.—*Lathyrus arvensis repens tuberosus* C.B.P. 344. *Lathyrus tuberosus* L. Sp. 732.—" Grows in cornfields. The roots are much relished by pigs."

Cap. XLVII : ASTER ATTICUS Diosc. IV, cxviii (cxx).

73. *Aster-atticus*, Sternkraut, 134 ; N.K. t. lxxiii ; Im. 73.—*Aster-atticus cæruleus vulgaris* C.B.P. 267. *Aster Amellus* L. Sp. 873.—" On hills and high mountains, and sometimes in woods."

Cap. XLVIII : AGROSTIS Diosc. IV, xxx.

74. *Gramen*, Grasz, 136 ; N.K. t. lxxiv. *Graminis genus*, Im. 74.—*Caryophyllus arvensis glaber flore majore* C.B.P. 210. *Stellaria Holostea* L. Sp. 422.—" In shady places, thickets, and hedges."

Cap. XLIX : ALOE Diosc. III, xxii (xxv).

75. *Aloe*, Aloen, 138 ; N.K. t. lxxv ; Im. 75.—*Aloe vulgaris* C.B.P. 286. *Aloe vera* L. Sp. 320 ; P.C. 7.—" Now planted in some gardens in Germany."

Cap. L : BECHION Diosc. III, cxvi (cxxvi).

76. *Tussilago* (*Farfaria, Ungula caballina*), Roszhuob, 140 ; N.K. t. lxxvi ; Im. 76.—Br. 8. *Tussilago vulgaris* C.B.P. 197. *Tussilago Farfara* L. Sp. 865 ; P.C. 77 ; L.P. 192.—" Beside water, and in rich uncultivated soil, and moist fields."

Cap. LI: BUGLOSSUM Diosc. IV, cxxvi (cxxviii).

77. *Buglossum* (*Borrago*), Borragen, 142; N.K. t. lxxvii; Im. 77.—Br. 36. *Buglossum latifolium Borrago* C.B.P. 256. *Borago officinalis* L. Sp. 137; P.C. 36; L.P. 68.—"Grows in flat sandy places, and is now everywhere found in gardens."—The description in N.K. is copied from Bock, 'New Kreütter Buoch,' p. lxv.

Cap. LII: BUPHTHALMUM Diosc. III, cxlvi (clvi).

78. *Buphthalmum* (*Oculis bovis*), Rindszaug, 144; N.K. t. lxxviii; Im. 78.—*Chamæmelum inodorum* C.B.P. 135. *Matricaria inodora* L. Fl. Suec. ed. 2, 297 (1755).—Habitat, "in campis et circa oppida," copied from Dioscorides.

Cap. LIII: BELLIS Plin. XXVI, v. 13.

79. *Bellis minor hortensis*, Monatbluom, 146; N.K. t. lxxix; Im. 79.—*Bellis hortensis flore pleno* C.B.P. 261. *Bellis perennis*, var. *hortensis* L. Sp. 886.—"Like the wild Daisy, except that the flowers are red: flowers sometimes single and sometimes double." Hist. 145. "There are many kinds, some double, others single, some white, others blood-red. Yet others are red and white mixed." N.K., cap. LIII.—"Planted in almost all gardens."

80. *Bellis minor sylvestris*, Maszlieben, 147; N.K. t. lxxx; Im. 80.—Br. 100. *Bellis sylvestris minor* C.B.P. 261. *Bellis perennis* L. Sp. 886.—"On heaths, and by streams."

81. *Bellis maior* [sphalm. "*minor*"], Genszbluom, 148; N.K. t. lxxxi; Im. 81.—Br. 90. *Bellis sylvestris caule folioso major* C.B.P. 261. *Chrysanthemum Leucanthemum* L. Sp. 888; P.C. 204.—"Grows abundantly in meadows."

Cap. LIV: BRATHYS Diosc. I, civ.

82. *Sabina*, Seuenbaum, 150; N.K. t. lxxxii; Im. 82.—*Sabina folio Tamarisci Dioscoridis* C.B.P. 487. *Juniperus Sabina* L. Sp. 1039 (planta ♂); P.C. 250; L.P. 185.—"In almost all gardens."

Cap. LV: BATOS Diosc. IV, xxxvii.

83. *Rubus*, Bromber, 152; N.K. t. lxxxiii; Im. 83.—Br. 260. *Rubus vulgaris, sive Rubus fructu nigro* C.B.P. 479. *Rubus fruticosus* L. Sp. 493; L.P. 98.—"Everywhere in thickets and hedges. After growing for some time the stems turn back and root in the soil."

Cap. LVI: BALLOTE Diosc. III, cvii (cxvii).

84. *Ballote* (*Marrubium nigrum*), Schwartz Andorn, 154; N.K. t. lxxxiv Im. 84.—*Marrubium nigrum fœtidum* C.B.P. 230. *Ballota nigra* L. Sp. 582; P.C. 135; L.P. 169.—"By waysides, old buildings, fences, churchyards, and other uncultivated places."

Cap. LVII: BATRACHION Diosc. II, ccvi.

85. *Ranunculi prima species sylvestris*, Wisen [sphalm. "Weisser"] Hanen-

fuosz, 156 ; N.K. t. lxxxv. *Ranunculi prima species*, Im. 85.—*Ranunculus nemorosus vel sylvaticus folio rotundo* C.B.P. 178. *Ranunculus auricomus* L. Sp. 551.—" By running water, lakes, and pools, and in moist meadows and orchards." The habitat " by running water " (" circa fluenta ") was taken from Dioscorides. " By lakes and pools " is apparently original, and suggests that Fuchs had confused *R. Flammula* L. with *R. auricomus*.

86. *Ranunculi hortensis simplicis prima species*, Ungefülter Garten Hanenfuosz, 157 ; N.K. t. lxxxvi. *Ranunculi altera species*, Im. 86.—*Ranunculus arvensis echinatus* C.B.P. 179. *Ranunculus arvensis* L. Sp. 555.—" In gardens and wet fields."

87. *Ranunculi prima species hortensis multiplicis*, Gefülter Hanenfuosz, 158 ; N.K. t. lxxxvii. *Ranunculus multiplex*, Im. 87.—Br. 48. *Ranunculus hortensis erectus flore pleno* C.B.P. 179. *Ranunculus acris*, var. β, L. Sp. 554 (flore pleno Hort.).- " Planted in gardens by maidens for making garlands."

88. *Ranunculi secunda species* (*Apium sylvestre, Agreste apium, Scelerata*), Wasser Hanenfuosz, 159 ; N.K. t. lxxxviii. *Ranunculus aquaticus*, Im. 88.—*Ranunculus palustris apii folio lævis* C.B.P. 180. *Ranunculus sceleratus* L. Sp. 551.—" By standing water and streams."

89. *Ranunculi tertia species*, Kleiner Hanenfuosz, 160 ; N.K. t. lxxxix. *Ranunculus minor*, Im. 89.--Br. 49. *Ranunculus pratensis radice verticilli modo rotunda* C.B.P. 179. *Ranunculus bulbosus* L. Sp. 554.—" Everywhere in orchards, meadows, and heaths."

90. *Ranunculi quarta species lactea*, Weisz Waldhenle, 161 ; N.K. t. xc. *Ranunculi quarta species*, Im. 91.—Br. 136. *Anemone nemorosa flore majore* C.B.P. 176. *Anemone nemorosa* L. Sp. 541.—" Common in woods."

91. *Ranunculi quarta species lutea*, Gelbsz Waldhenle, 162 ; N.K. t. xci. *Tertia Ranunculi species*, Im. 90.—*Ranunculus nemorosus luteus* C.B.P. 178. *Anemone ranunculoides* L. Sp. 541.—" In hedges and water-meadows. Abundant in the valley above and below the monastery of Bebenhausen."

Cap. LVIII : BRYON auct. Græc. recentior. *ex* Fuchs.
LUPUS SALICTARIUS Plin. XXI, xv. 50.

92. *Lupus-salictarius* (*Lupulus, Humulus*), Hopffen, 164 ; N.K. t. xcii ; Im. 92.—Br. 277. *Lupulus mas* C.B.P. 298. *Humulus Lupulus* L. Sp. 1028 ; P.C. 134 ; L.P. 131.—" The wild Hop grows everywhere on fences and hedges, by ditches, and on walls. The cultivated kind is planted in gardens and fields for beer-making."

Cap. LIX : VERONICA herbariorum *ex* Fuchs.

93. *Veronica mas*, Erenbreisz mennle, 166 ; N.K. t. xciii ; Im. 93.—*Veronica mas supina et vulgatissima* C.B.P. 246. *Veronica officinalis* L. Sp. 11 ; P.C. 267 ; L.P. 133.—" In uncultivated places, especially in woods, under oak-trees."

94. *Veronica fœmina*, Erenbreisz weible, 167; N.K. t. xciv; Im. 94.—*Elatine folio subrotundo* C.B.P. 252. *Antirrhinum spurium* L. Sp. 613. *Linaria spuria* Mill.—" On dry sandy and clayey hills."

Cap. LX : BULBUS SYLVESTRIS [*vide* BULBUS ESCULENTUS Diosc. II, cc].

95. *Bulbus-sylvestris*, Feldzwibel, 169; N.K. t. xcv; Im. 95.—*Ornithogalum luteum* C.B.P. 71. *Ornithogalum luteum* L. Sp. 306. *Gagea lutea* Ker-Gawl.—" Abundant in shady places, and near the margins of certain meadows. Occurs in quantity in the valleys near the monastery of Bebenhausen, not far from Tübingen, and in a meadow at the foot of the Osterberg."

Cap. LXI : BICION Galen, op. ed. Kühn, vi. 550.

96. *Vicia*, Wicken, 172; N.K. t. xcvi; Im. 96.—Br. 226. *Vicia sativa* L. Sp. 736.—" Everywhere among corn, especially oats and barley." The shape of the leaflets suggests *Vicia angustifolia* All. (*V. angustifolia* Riv.), but the size of the flowers and the statement that the seeds are lenticular, not globose, point to *V. sativa*.

Cap. LXII : BLITUM Diosc. II, cxliii.

97. *Blitum*, Maier, 174; N.K. t. xcvii. *Bliti genus*, Im. 97.—*Chenopodium polyspermum* L. Sp. 220.—" Occurs spontaneously almost everywhere in Germany. When once introduced into a garden, it is difficult to eradicate, as it sows itself each year."

Cap. LXIII : BUNIAS Diosc. II, cxxxvi.

98. *Napus-Bunias sativus*, Trucken Steckrueben, 176; N.K. t. xcviii; Im. 98.—*Brassica campestris* L. var. *Rapa* (L.) Hartm., subvar. *oblonga* (Mill.) O. E. Schulz—*vide* Engl. Pflanzenr., Crucif.-Brassic. i. 51.—" Likes cold situations. Much cultivated in some localities."

99. *Napus-Bunias sylvestris*, Nasz Steckrueben, 177; N.K. t. xcix; Im. 99.—*Brassica campestris* L. var. *Rapa* (L.) Hartm., subvar. *depressa* (DC.) O. E. Schulz—*vide* Engl. Pflanzenr. Crucif.-Brassic. i. 51.—Hab. as in No. 98.

Cap. LXIV : BOTRYS Diosc. III, cxx (cxxx).

100. *Botrys*, Traubenkraut, 179; N.K. t. c (juxta finem tomi); Im. 100.—*Botrys Ambrosioides vulgaris* C.B.P. 138. *Chenopodium Botrys* L. Sp. 219; L.P. 175.—" In Germany known only in cultivation."

Cap. LXV : BARBA CAPRI Fuchs.

101. *Barba-capri* (*Barba caprina*), Wald Geiszbart, 181; N.K. t. ci; Im. 101.—*Barba capræ floribus oblongis* C.B.P. 163. *Spiræa Aruncus* L. Sp. 490. *Aruncus sylvester* Kostel.—" In dark woods, and certain shady valleys."—The other species mentioned as occurring in moist meadows was evidently *Filipendula Ulmaria* Maxim. (*Spiræa Ulmaria* L.).

Cap. LXVI : BLATTARIA Plin. XXV, ix, 60.

102. *Blattaria*, Schabenkraut, 183 ; N.K. t. cii ; Im. 102.—*Blattaria lutea folio longo laciniato* C.B.P. 240. *Verbascum Blattaria* L. Sp. 178.—" By water, and on the banks of streams."

Cap. LXVII : BROMUS Diosc. II, cxvi.

103. *Avena*, Habern, 185 ; N.K. t. ciii ; Im. 103.—Br. 219. *Avena vulgaris seu alba* C.B.P. 23. *Avena sativa*, var. *β*, L. Sp. 79 ; P.C. 200.—" Cultivated everywhere in Germany, rather as fodder for horses than as food for men."

Cap. LXVIII : UVA CRISPA vulgo *ex* Fuchs [*vide* RHAMNUS Diosc. I, cxix].

104. *Uva-crispa*, Krüselbeer, 187 ; N.K. t. civ ; Im. 104.—*Grossularia simplici acino, vel spinosa sylvestris* C.B.P. 455. *Ribes Uva-crispa* L. Sp. 201.—" In bushy places, and in hedges, but not everywhere. Abundant round Tübingen."

Cap. LXIX : BALSAMINE vulgo *ex* Fuchs.

105. *Balsamine prima* (*Charantia*), Balsamkraut mennle, 189 ; N.K. t. cv ; Im. 105.—*Balsamina rotundifolia repens, sive mas* C.B.P. 306. *Momordica Balsamina* L. Sp. 1009.—" A recent introduction, planted already in many gardens."

106. *Balsamine altera*, Balsamkraut weible, 190 ; N. K. t. cvi ; Im. 106.—*Balsamina fœmina* C.B.P. 306. *Impatiens Balsamina* L. Sp. 938.—" A recent introduction, planted already in many gardens."

Cap. LXX : GLYCYRRHIZA Diosc. III, v (vii).

107. *Glycyrrhiza* (*Liquiritia*), Sueszholtz, 192 ; N.K. t. cvii ; Im. 107.—Br. 182. *Glycyrrhiza siliquosa vel Germanica* C.B.P. 352. *Glycyrrhiza glabra* L. Sp. 742 ; P.C. 168 ; L.P. 193.—" The best liquorice grows in Cappadocia and Pontus " [copied from Diosc.]. " Much is produced in Germany, especially in the country round Babenberg. When once planted it creeps hither and thither, and can never be eradicated."

Cap. LXXI : GALEOPSIS Diosc. IV, xciii (xcv).

108. *Galeopsis* (*Scrophularia maior, Ficaria*), Braunwurtz, 194 ; N.K. t. cviii ; Im. 108.—Br. 73. *Scrophularia aquatica* L. Sp. 620 ; P.C. 294. Habitat in ' Historia Stirpium ' copied from Dioscorides ; in ' New Kreüterbuoch,' " behind fences, on old walls, and by water."

Cap. LXXII : GALLION Diosc. IV, xciv (xcvi).

109. *Gallium*, Unser Frawen Wegstro, Walstro, 196 ; N.K. t. cix ; Im. 109.—*Galium luteum* C.B.P. 335. *Galium verum* L. Sp. 107 ; P.C. 158 ; L.P. 174.—" In cultivated fields, and meadows, and in some damp orchards."

Cap. LXXIII : GLECHON Diosc. III, xxxiii (xxxvi).

110. *Pulegium* (*Pulegium mas*), Poley, 198 ; N.K. t. cx. *Pulegium fœmina*,

Im. 110.—Br. 80. *Pulegium latifolium* C.B.P. 222. *Mentha Pulegium* L. Sp. 577 ; P.C. 211.—" Likes humid cultivated places, and when once sown creeps hither and thither and spreads over a whole field."

Cap. LXXIV : GENTIANA Diosc. III, iii.

111. *Gentiana*, Entzian, 200 ; N.K. t. cxi ; Im. 111.—*Gentiana major lutea* C.B.P. 187. *Gentiana lutea* L. Sp. 227 ; P.C. 114 ; L.P. 114.—General habitat, and occurrence in Illyria, copied from Dioscorides. " Abundant . . . . on the Farrenberg near Tübingen."

Cap. LXXV : GLYCYSIDA Diosc. III, cxlvii (clvii).

112. *Pæonia fœmina*, Peonienbluom, Gichtwurtz, 202 ; N.K. t. cxii ; Im. 113.—*Pæonia communis vel fœmina* C.B.P. 323. *Pæonia officinalis* var. *feminea* L. Sp. 530. *Pæonia peregrina* Mill. Gard. Dict. n. 3 (1768).—*vide* Huth in Engl. Jahrb. xiv. 270.—" Planted in all gardens in Germany."

Cap. LXXVI : GERANIUM Diosc. III, cxxi (cxxxi).

113. *Geranium primum*, Storckenschnabel, 204 ; N.K. t. cxiii ; Im. 114.—Br. 108. *Geranium cicutarium* L. Sp. 680. *Erodium cicutarium* L'Hérit.—" In poor sandy soil by roadsides and in corn-fields."

114. *Geranium alterum* (*Pes columbinus*), Daubenfuosz, 205 ; N.K. t. cxiv ; Im. 115.—*Geranium folio Malvæ rotundo* C.B.P. 318. *Geranium rotundifolium* L. Sp. 683.—" On sandy hills and in gardens."—A poor figure, the petals being shown as shorter than the sepals except in one instance. Sprengel identified it as *G. molle* L., which has bifid petals.

115. *Geranium tertium* (*Herba Roberti*, *Robertiana*), Ruoprechtskraut, 206 ; N.K. t. cxv ; Im. 116.—*Geranium Robertianum primum* C.B.P. 319. *Geranium Robertianum* L. Sp. 681 ; L.P. 111.—" In shady uncultivated places, and almost everywhere in hedges."

116. *Geranium quartum*, Kranichhalsz, 207 ; N.K. t. cxvi ; Im. 117.—*Geranium dissectum* L. Cent. i. 21 ; Sp. ed. 2, 956.—" In fields, by fences, and in churchyards."—Not a good figure, but accepted as *G. dissectum* by Sprengel, and by Pritzel and Jessen.

117. *Geranium quintum*, Gottes Gnad, 208 ; N.K. t. cxviii ; Im. 118.—*Geranium batrachioides* C.B.P. 318. *Geranium pratense* L. Sp. 681.—" Almost everywhere in meadows."

118. *Geranium sextum*, Bluotwurtz, 209 ; N.K. t. cxvii ; Im. 119.—*Geranium sanguineum maximo flore* C.B.P. 318. *Geranium sanguineum* L. Sp. 683.—" On high stony mountains."—The habitats of this and the preceding species are transposed in N.K.

Cap. LXXVII : RAPUM Diosc. II, cxxxiv (cxxxv).

119. *Rapum sativum*, Weisz Rueben, 212 ; N.K. t. cxix. *Rapum sativum*

album, Im. 120.—*Brassica Napus* var. *napobrassica* (L.) Reichb. ("Swede")—*vide* Engl. Pflanzenr., Crucif.-Brassic. i. 44.—"Sown in moist fields almost everywhere in Germany."

120. *Rapum rubrum*, Rot Rueben, 213; N.K. t. cxx. *Rapum sativum rubrum*, Im. 121.—Br. 255. *Beta vulgaris* L. Sp. 222, var. *cruenta* Alef. Landwirthsch. Fl. 279 ("Beetroot").—"Sown in moist fields almost everywhere in Germany."

121. *Rapum sylvestre* (*Rapunculus*), Rapuntzeln, 214; N.K. t. cxxi; Im. 122.—Br. 138. *Rapunculus esculentus* C.B.P. 92. *Campanula Rapunculus* L. Sp. 164.—"Here and there beside fences and in fields."

Cap. LXXVIII: GINGIDIUM Diosc. II, clxvi (clxvii).

122. *Gingidium* (*Chærefolium*), Kerbelkraut, 216; N.K. t. cxxii; Im. 123.—Br. 192. *Chærophyllum sativum* C.B.P. 152. *Scandix Cerefolium* L. Sp. 257. *Anthriscus Cerefolium* Hoffm.—"Everywhere cultivated in gardens."

Cap. LXXIX: GENISTA Plin. XXIV, ix. 40.

123. *Genista* (*Genesta*, *Genestra*), Ginst, 218; N.K. t. cxxiii; Im. 124.—Br. 197. *Genista angulosa et scoparia* C.B.P. 395. *Spartium scoparium* L. Sp. 709. *Sarothamnus scoparius* Wimmer; P.C. 38; L.P. 284.—"Likes arid sandy places in or near woods."

Cap. LXXX: GENISTELLA nonnullorum *ex* Fuchs.

124. *Genistella*, Stechende Ginst, Erdtpfrimmen, 220; N.K. t. cxxiv; Im. 125.—*Genista spinosa minor Germanica* C.B.P. 395. *Genista germanica* L. Sp. 710.—"In arid, sandy, uncultivated fields and by waysides."

Cap. LXXXI: GNAPHALIUM Diosc. III, cxxii (cxxxii).

125. *Gnaphalium*, Rhuerkraut, 222; N.K. t. cxxv; Im. 126.—*Gnaphalium vulgare majus* C.B.P. 263. *Gnaphalium germanicum* L. Sp. 857. *Filago germanica* L. Sp. ed. 2, 1311.—"Likes arid places." The right-hand branch of the figure represents a "second species," which we have not identified. It is doubtless this that is found "in damp localities."

Cap. LXXXII: DIPSACUS Diosc. III, xi (xiii).

126. *Dipsacus albus* (*Cardo fullonum*, *Carduus fullonius*), Weisz Kartendistel, 224; N.K. t. cxxvi; Im. 127.—*Dipsacus sativus* C.B.P. 385. *Dipsacus fullonum*, var. *β*, L. Sp. 97. *D. fullonum* L. emend. Huds. Fl. Angl. 49 (1762).—"Planted in gardens by fullers."

127. *Dipsacus purpureus*, Braun Kartendistel, 225; N.K. t. cxxvii; Im. 128.—Br. 126. *Dipsacus sylvestris aut Virga pastoris major* C.B.P. 385. *Dipsacus fullonum*, var. *α*, L. Sp. 97. *Dipsacus sylvestris* Huds. Fl. Angl. 49 (1762).—"In damp places, by water and streams."

Cap. LXXXIII : DAPHNOIDES Diosc. IV, cxlvi (cxlviii).

128. *Daphnoides* (*Laureola*), Zeilant, Zeiland, 227 ; N.K. t. cxxviii ; Im. 129.—*Laureola folio deciduo flore purpureo* : *officinis Laureola fœmina* C.B.P. 462. *Daphne Mezereum* L. Sp. 356 ; P.C. 187.—" In mountain woods almost everywhere."

Cap. LXXXIV : DRYS Diosc. I, cxlii.

129. *Quercus*, Eichbaum, 229 ; N.K. t. cxxix ; Im. 130.—*Quercus cum longo pediculo* C.B.P. 420. *Quercus Robur* L. Sp. 996 (*Q. pedunculata* Ehrh.) ; P.C. 200 ; L.P. 85.—" Everywhere, more especially in woods."

Cap. LXXXV (CCCIV, CCCV, N.K.) : DAUCUS Diosc. III, lxxvi (lxxxiii). TORDYLON Diosc. III, lvi (lxiii). SESELI Diosc. III, liv–lv (lxi–lxii).

130. *Daucus creticus*, Berwurtzel, Beerwurtz, 231 ; *Tordylon*, N.K. t. ccccli. *Seseli Creticum*, Im. 413.—Br. 274. *Meum foliis anethi* C.P.B. 148. *Athamanta Meum* L. Sp. 245. *Meum athamanticum* Jacq.—" On high mountains, and abundantly in meadows in the Black Forest ; also cultivated in gardens."—Fuchs later (Hist. p. 809) identified this species with *Tordylon* (*Seseli creticum*) Diosc.—*vide* Cap. CCCXII.

131. *Dauci alterum genus*, Weisz Hirtzwurtz, 232 ; N.K. t. ccccxlix. *Seseli Æthiopicum*, Im. 411.—*Libanotis latifolia altera sive vulgatior* C.B.P. 157. *Laserpitium latifolium* L. Sp. 248.—" On high mountains."—This and the following species were referred by Fuchs in his ' Historia Plantarum ' to *Daucus* Diosc., and in the ' New Kreüterbuoch ' to *Seseli* Diosc.

132. *Dauci tertium genus*, Schwartz Hirtzwurtz, 233 ; N.K. t. ccccl. *Seseli Peloponnesiacum*, Im. 412.—*Daucus montanus apii folio major* C.B.P. 150. *Athamanta Cervaria* L. Sp. ed. 2, 352. *Peucedanum Cervaria* Lapeyr. Hist. Abrég. Pl. Pyrén. i. 149 (1818).—" On rough moist places, and on hills."

Cap. LXXXVI (LXXXV, N.K.) : DRACONTION MAGNUM Diosc. II, cxcv.

133. *Dracunculus*, Schlangenkraut, 235 ; N.K. t. cxxx ; Im. 131.—Br. 16. *Dracunculus polyphyllus* C.B.P. 195. *Arum Dracunculus* L. Sp. 964. *Dracunculus vulgaris* Schott.—Habitat " in shady hedges " copied from Dioscorides.

Cap. LXXXVII : DAPHNE ALEXANDRINA Diosc. IV, cxlv (cxlvii).

134. *Laurus-Alexandrina*, Zaepfflinkraut, 238 ; N.K. t. cxxxii. *Daphne-Alexandrina*, Im. 133.—Br. 169. *Laurus Alexandrina fructu pediculo insidente* C.B.P. 304. *Ruscus Hypoglossum* L. Sp. 1041.—" Now brought from Hungary, and planted in some gardens."

Cap. LXXXVIII : EPHEMERUM NON LETALE Diosc. IV, lxxxv.

135. *Ephemerum-non-letale* (*Lilium convallium*), Meyenbluemle, 240 ; N.K. t. cxxxiii ; Im. 134.—Br. 72. *Lilium convallium album* C.B.P. 304. *Convallaria majalis* L. Sp. 314 ; P.C. 164 ; L.P. 280.—" In woods and shady places."

Cap. LXXXIX : Elenium Diosc. I, xxvii.

136. *Elenium* (*Inula, Enula campana*), Alant, 242 ; N.K. t. cxxxiv ; Im. 135.—Br. 170. *Helenium vulgare* C.B.P. 276. *Inula Helenium* L. Sp. 881 ; P.C. 97 ; L.P. 196.—" In mountainous, shady and dry places " (copied from Dioscorides, ed. Ruellius). " Sometimes also in woods, uncultivated borders of fields, thorn hedges, and meadows. Found almost everywhere in gardens, where it is planted."

Cap. XC : Eupatorium Diosc. IV, xli.

137. *Eupatorium* (*Agrimonia*), Odermenig, 244 ; N.K. t. cxxxv ; Im. 136.—Br. 160. *Eupatorium veterum sive Agrimonia* C.B.P. 321. *Agrimonia Eupatoria* L. Sp. 448 ; P.C. 5 ; L.P. 97.—" Everywhere in hedges, in dark and uncultivated places, on rough and stony mountains, and beside fences and roads."

Cap. XCI : Euphrasia officinarum *ex* Fuchs.

138. *Euphrasia* (*Ophthalmica, Ocularia*), Augentrost, 246 ; N.K. t. cxxxvi ; Im. 137.—Br. 58. *Euphrasia officinarum* C.B.P. 233. *Euphrasia officinalis* L. Sp. 604 ; P.C. 102 ; L.P. 111.—" On sunny hills and borders of fields, and in almost all meadows."

Cap. XCII : Elisphacon Diosc. III, xxxv (xl).

139. *Salvia maior*, Grosz Salbey, 248 ; N.K. t. cxxxvii ; Im. 138.—Br. 140. *Salvia major* C.B.P. 237. *Salvia officinalis* L. Sp. 23 ; P.C. 236 ; L.P. 78.—" Grows in rough places [taken from Diosc.], and found everywhere in gardens to-day."

140. *Salvia minor*, Creütz Salbey, 249 ; N.K. t. cxxxviii ; Im. 139.—*Salvia minor aurita et non aurita* C.B.P. 237. *Salvia officinalis*, var. *β*, L. Sp. 23. *Salvia officinalis* var. *aurita* Spreng. Gesch. Bot. i. 264.—Hab. as in No. 139.

Cap. XCIII : Erpyllon Diosc. III, xl (xlvi).

141. *Serpyllum* [*sylvestre*], Quendel, 251 ; N.K. t. cxxxix ; Im. 140.—Br. 98. *Serpyllum vulgare minus* C.B.P. 220. *Thymus Serpyllum* L. Sp. 590 ; P.C. 282 ; L.P. 146.—" On rocks, hills, mountains, and dry meadows almost everywhere. But the white kind, which I have only once found in the valley of Bebenhausen near Tübingen, does not grow in all localities."

Cap. XCIV : Elymus Diosc. II, cxx.

142. *Panicum*, Pfenich, Fench, 253 ; N.K. t. cxl (sphalm. " cxli ") ; Im. 141.—*Setaria italica* Beauv.—" Now planted in many places, and likes rough and sandy ground."

Cap. XCV : Erica Diosc. I, cxvii.

143. *Erice*, Heyden, 255 ; N.K. t. cxli ; Im. 142.—*Erica vulgaris glabra* C.B.P. 485. *Erica vulgaris* L. Sp. 352. *Calluna vulgaris* Salisb. ; L.P. 52.—" Everywhere on mountains, and in woods and sandy places."

Cap. XCVI : ERYSIMON Diosc. II, clxxxvii (clxxxviii).

144. *Irion* (*Sinapis sylvestris*, *Rapistrum*), Hederich, 257 ; N.K. t. cxlii ; Im. 143.—Br. 191. *Rapistrum flore luteo* C.B.P. 95. *Sinapis arvensis* L. Sp. 668 ; L.P. 206.—Habitat copied from Dioscorides.

Cap. XCVII : HELXINE CISSAMPELOS Diosc. IV, xxxix.

145. *Helxine-cissampelos* (*Convolvulus*, *Volubilis media*), Mittelwind, 258 ; N.K. t. cxliii ; Im. 144.—*Convolvulus minor arvensis* C.B.P. 294. *Convolvulus arvensis* L. Sp. 153.—" In vineyards, and sometimes in gardens and dry meadows."

Cap. XCVIII : HEPTAPHYLLUM Apuleius Barbarus, ed. Humelbergius, cxvi.

146. *Heptaphyllum* (*Tormentilla*), Tormentill, 260 ; N.K. t. cxliv ; Im. 145.—Br. 22. *Tormentilla sylvestris* C.B.P. 326. *Tormentilla erecta* L. Sp. 500. *Potentilla erecta* Hampe ; P.C. 284 ; L.P. 96.—" In high mountain meadows, and in woods almost everywhere."

Cap. XCIX : ERUCA Diosc. II, clxix (clxx).

147. *Eruca sativa*, Zam weisz Senff, 262 ; N.K. t. cxlv ; Im. 146.—*Eruca*, N.H. cap. XCIX.—*Sisymbrium tenuifolium* L. Sp. ed. 2, 917. *Diplotaxis tenuifolia* DC. ; O. E. Schulz in Engl. Pflanzenr., Crucif.-Brassic. i. 158 ; L.P. 201.—" Sown in gardens. A recent introduction into Germany."—Erroneously referred to *Brassica Eruca* L. (*Eruca sativa* Mill.) by Sprengel. That species is figured by Fuchs on p. 539 (No. 305).

148. *Eruca sylvestris*, Wild weisz Senff, 263 ; N.K. t. cxlvi. *Sinapi primum genus sylvestre*, Im. 305.—*Eruca sylvestris minor luteo parvoque flore* C.B.P. 98. *Sisymbrium sylvestre* L. Sp. 657. *Nasturtium sylvestre* R. Br. *Rorippa sylvestris* Besser.—" By water, and in stony places sometimes covered with water."

Cap. C : EUPATORIUM ADULTERINUM Fuchs.

149. *Eupatorium-adulterinum*, Kunigunt (Künigund) Kraut, 265 ; N.K. t. cxlvii ; Im. 148.—*Eupatorium cannabinum* C.B.P. 320. *Eupatorium cannabinum* L. Sp. 838 ; P.C. 130.—" By the banks of streams and in other damp places, more especially by ponds and slow running water."

Cap. CI : EREBINTHOS Diosc. II, cxxvi.

150. *Cicer nigrum*, Schwartz Zyszern (Zisern), 267 ; N.K. t. cxlviii ; Im. 149.—Br. 253. *Cicer sativum* C.B.P. 347. *Cicer arietinum* L. Sp. 738.—" Likes rich blackish soil."

Cap. CII : ECHION Diosc. IV, xxvii.

151. *Echion* (*Buglossum sylvestre*), Wild Ochsenzungen, 269 ; N.K. t. cxlix. *Echium germanicum spinosum*, Im. 151.—*Buglossum sylvestre minus* C.B.P. 256. *Lycopsis arvensis* L. Sp. 139.—" Local, but where it does occur, as round

Rotenburg am Neckar, is everywhere abundant by roadsides and in rough places."

Cap. CIII : ELEOSELINON Diosc. III, lxviii (lxxv).

152. *Apium-palustre*, Wasser Eppich, Wasserepff, 270 ; N.K. t. cl. *Sii primum genus quod Laver vulgo dicitur*, Im. 420.—*Sion sive Apium palustre foliis oblongis* C.B.P. 154. *Sium angustifolium* L. Sp. ed. 2, 1672.—" In marshes and pools, and by streams."

Cap. CIV : ELLEBORUS ALBUS Diosc. IV, cxlviii (cl).

153. *Elleborus-albus* (*Elleborus candidus*, *Veratrum album*), Weisz Nieszwurtz, 272 ; N.K. t. cli ; Im. 154.—*Helleborus albus flore subviridi* C.B.P. 186. *Veratrum album* L. Sp. 1044 ; L.P. 261. —" In cold, rough, and mountainous places " (partly from Dioscorides).

Cap. CV : ELLEBORUS NIGER ADULTERINUS Fuchs.

154. *Elleborus-niger-adulterinus hortensis* (*Elleborum nigrum*), Christwurtz, 274 ; N.K. t. clii ; Im. 155.—Br. 5. *Helleborus niger hortensis flore viridi* C.B.P. 185. *Helleborus viridis* L. Sp. 558.—" Now grown everywhere in gardens."

155. *Elleborus-niger-adulterinus sylvestris*, Leüszkraut, 275 ; N.K. t. cliii ; Im. 156.—*Helleborus niger fœtidus* C.B.P. 185. *Helleborus fœtidus* L. Sp. 558.— " On rough stony places, and mountains, occurring abundantly by roadsides."

Cap. CVI : HELXINE Diosc. IV, xxxix.

156. *Helxine* (*Parietaria*), Tag und Nacht, 277 ; N.K. t. cliv ; Im. 157.— Br. 91. *Parietaria officinarum et Dioscoridis* C.B.P. 121. *Parietaria officinalis* L. Sp. 1052 ; P.C. 210 ; L.P. 46.—" By fences and walls. Also planted in many gardens."

Cap. CVII : ERYTHRODANON Diosc. III, cl (clx).

157. *Rubia sativa* (*Rubea tinctorum*), Roete die zam, 280 ; N.K. t. clv ; Im. 158.—*Rubia tinctorum sativa* C.B.P. 333. *Rubia tinctorum*, var. *β*, L. Sp. 109 ; P.C. 175.—" In fields in many places in Germany, especially round Hagenau, Speier and Strasburg. Propagated by cuttings."

158. *Rubia sylvestris*, Roete die wild, 281 ; N.K. t. clvi ; Im. 159.—*Rubia sylvestris lævis* C.B.P. 333. *Galium Mollugo* L. Sp. 107.—" By fences and thorn-hedges."

Cap. CVIII : ZEA Diosc. II, cxi.

159. *Zeæ primum genus* (*Spelta*), Speltz, 283 ; N.K. t. clvii ; Im. 160.— Br. 220. *Zea dicoccus vel major* C.B.P. 22. *Triticum Spelta* L. Sp. 86.— " Requires well-cultivated soil."

160. *Zeæ alterum genus*, Einkorn, 284 ; N.K. t. clviii ; Im. 161.—*Zea Briza dicta, vel Monococcus Germanica* C.B.P. 21. *Triticum monococcum* L. Sp. 86.— ' Does not require such good or manured soil as Speltz."

Cap. CIX : ERIGERON Diosc. IV, xcv (xcvii).

161. *Senetio*, Creützwurtz, Grindtkraut, 286 ; N.K. t. clix ; Im. 162.—Br. 38. *Senecio minor vulgaris* C.B.P. 131. *Senecio vulgaris* L. Sp. 857 ; P.C. 124 ; L.P. 178.—" Everywhere in gardens and by fences and walls."

Cap. CX : HEDYOSMON Diosc. III, xxxvi (xli).

162. *Menta* (*Menta hortensis prima*), Krausz Deyment, 288 ; N.K. t. clx. *Menta sativa prima*, Im. 163.—*Mentha crispa verticillata* C.B.P. 227. *Mentha sativa* L. Sp. ed. 2, 805.—" Grown everywhere in gardens."

163. *Menta hortensis secunda*, Krausz Balsam, 289 ; N.K. t. clxi. *Menta sativa altera*, Im. 164.—*Mentha rotundifolia* L. Sp. ed. 2, 805.—" Grown everywhere in gardens."

164. *Menta hortensis tertia*, Unser Frawen Müntz, 290 ; N.K. t. clxii. *Menta sativa tertia*, Im. 165.—*Mentha angustifolia spicata* C.B.P. 227. *Mentha viridis* L. Sp. 576 ; P.C. 266 ; L.P. 142.—" Grown everywhere in gardens."

165. *Menta hortensis quarta*, Hertzkraut, 291 ; N.K. t. clxiii ; Im. 166.—*Mentha hortensis verticillata ocimi odore* C.B.P. 227. *Mentha gentilis* L. Sp. 577.—" Grown everywhere in gardens."

166. *Mentastrum* (*Menta sylvestris*, *Menta equina*), Roszmüntz, 292 ; N.K. t. clxiv ; Im. 167.—*Mentha sylvestris longiore folio* C.B.P. 227. *Mentha viridis* var. *longifolia* L. Sp. 576. *Mentha sylvestris* L. Sp. ed. 2, 804 ; P.C. 137.—" Likes mossy and damp places."

Cap. CXI : HEMIÓNITIS Diosc. III, cxlii (clii).

167. *Hemionitis* (*Scolopendria*, *Lingua cervina*), Hirszzungen, Hirtzzung, 294 ; N.K. t. clxv ; Im. 168.—Br. 110. *Lingua cervina officinarum* C.B.P. 353. *Asplenium Scolopendrium* L. Sp. 1079. *Phyllitis Scolopendrium* (L.) Newman ; P.C. 126.—" On shady moist mountains in stony valleys, by some streams, and on walls. Abundant near the Farnberg not far from Tübingen. Now planted in almost all gardens."

Cap. CXI *bis* (CXII, N.K.) : ERYNGIUM Diosc. III, xxi (xxiv).

168. *Eryngium* (*Iringus*), Mansztrew, 296 ; N.K. t. clxvi. *Eryngii species*, Im. 169.—*Eryngium vulgare* C.B.P. 386. *Eryngium campestre* L. Sp. 233 ; P.C. 99 ; L.P. 65.—" Likes dry heaths. Grows in some fields in the Rhine district, usually by roadsides. Abundant near Strasburg."

Cap. CXII (CXIII, N.K.) : THRIDAX Diosc. II, clxiv (clxv), clxv (clxvi).

169. *Lactuca sativa crispa et rotunda*, Krauser und breiter Lattich, 299 ; N.K. t. clxvii ; Im. 170.—*Lactuca crispa* C.B.P. 123. *Lactuca sativa* var. *crispa* L. Sp. 795 (the lowest leaves).—A composite figure, the upper leaves being those of some other broad-leaved variety of *L. sativa*.—" Sown in gardens."

170. *Lactuca capitata*, Grosser Lattich, 300; N.K. t. clxviii; Im. 171.—*Lactuca sativa* C.B.P. 122. *Lactuca sativa* L. Sp. 795; L.P. 227.—"Sown in gardens."

171. *Lactuca sylvestris*, Wild Lattich, 301; N.K. t. clxix; Im. 172.—*Lactuca sylvestris costa spinosa* C.B.P. 123. *Lactuca Scariola* L. Sp. ed. 2, 1119.—"By fences and vineyard walls, and in fields."

Cap. CXIII (CXIV, N.K.): THYMBRA Diosc. III, xxxix (xlv).

172. *Satureia sativa*, Joseplen, Saturon, 304; N.K. t. clxx; Im. 173.—*Satureia hortensis sive Cunila sativa Plinii* C.B.P. 218. *Satureja hortensis* L. Sp. 568; P.C. 250; L.P. 34, 152.—"Sown everywhere in gardens."

Cap. CXIV (CXV, N.K.): THLASPI Diosc. II, clxxxv (clxxxvi).

173. *Thlaspi latifolium*, Baurnsenff, 306; N.K. t. clxxi; Im. 174.—*Thlaspi arvense Vaccariæ incano folio majus* C.B.P. 106. *Thlaspi campestre* L. Sp. 646. *Lepidium campestre* R. Br.—"In wayside fields and by old homesteads and walls."

174. *Thlaspi angustifolium*, Besemkraut, 307; N.K. t. clxxii; Im. 175.—Br. 146. *Nasturtium sylvestre Osyridis folio* C.B.P. 105. *Lepidium ruderale* L. Sp. 645.—Same habitat as No. 173.

Cap. CXV (CXVI, N.K.): THERMOS Diosc. II, cxxxii.

175. *Lupinus*, Feigbon, 309, N.K. t. clxxiii. *Lupini albi*, Im. 176. *Lupinus sativus flore albo* C.B.P. 347. *Lupinus albus* L. Sp. 721.—"Likes hot sandy soil."

Cap. CXVI (CXVII, N.K.): ION Diosc. IV, cxx (cxxii).

176. *Viola-purpurea* (*Viola*), Mertzen Veiel, 311; N.K. t. clxxiv; Im. 177.—Br. 44. *Viola Martia purpurea flore simplici odoro* C.B.P. 199. *Viola odorata* L. Sp. 934; P.C. 291; L.P. 21.—"In shady and rough places [Diosc.], especially by garden fences and walls, and in hedges."

Cap. CXVII (CXVIII, N.K.): VIOLA MATRONALIS vulgo *ex* Fuchs.

177. *Viola-matronalis alba*, Weisz welsch Veiel, 313; N.K. t. clxxv; Im. 178.—Br. 120. *Leucoium incanum majus* C.B.P. 200. *Cheiranthus incanus* L. Sp. 662. *Matthiola incana* R. Br.—"In gardens. The three kinds [Nos. 177–179] differ only in the colour of the flowers."

178. *Viola-matronalis punicea*, Rot welsch Veiel, 314; N.K. t. clxxvi; Im. 179.—*Leucoium purpureum vel rubrum* C.B.P. 200. *Cheiranthus incanus* L. Sp. 662. *Matthiola incana* R. Br.—"In gardens."

179. *Viola-matronalis purpurea*, Braun welsch Veiel, 315; N.K. t. clxxvii; Im. 180.—*Leucoium purpureum vel rubrum* C.B.P. 200. *Cheiranthus incanus* L. Sp. 662. *Matthiola incana* R. Br.—"In gardens."

Cap. CXVIII (CXIX, N.K.): IRIS Diosc. I, i.

180. *Iris germanica*, Blaw Gilgen, 317; N.K. t. clxxviii; Im. 181.—Br. 230. *Iris vulgaris Germanica sive sylvestris* C.B.P. 30. *Iris germanica* L. Sp. 38; L.P. 22.—"Planted in gardens. Also grows on old walls and roofs, where it is commonly planted."

Cap. CXIX (CXX, N.K.): HIERACEUM Diosc. III, lxv (lxxii), lxvi (lxxiii).

181. *Hieraceum maius* (*Sonchites*), Grosz Habichkraut, 319; N.K. t. clxxix; Im. 182.—*Hieracium majus folio Sonchi, vel Hieracium Sonchites* C.B.P. 126. *Sonchus arvensis* L. Sp. 793.—"In meadows and borders of fields, and by ditches."

182. *Hieraceum minus*, Klein Habichkraut, 320; N.K. t. clxxx; Im. 183. —*Crepis tectorum* L. Sp. 807.—"In meadows."—Cited by Linné (Sp. 799) under *Leontodon autumnalis*, with which Fuchs may possibly have confused it.

Cap. CXX (CXXI, N.K.): HIPPURIS Diosc. IV, xlvi, xlvii.

183. *Equisetum longius*, Gross Rosszagel, Grosz Roszschwantz, 322; N.K. t. clxxxi. *Hippuris*, N.H. cap. CXXI. *Polygonum fœmina*, Im. 353.—*Equisetum palustre* L. Sp. 1061, *teste* Milde, Monogr. Equiset. 36; L.P. 55.—"In swamps and ditches."

184. *Equisetum minus*, Klein Roszschwantz, 323; N.K. t. clxxxii. *Equisetum brevius*, N.H. cap. CXXI. *Equisetum*, Im. 184.—*Equisetum arvense longioribus setis* C.B.P. 16. *Equisetum arvense* L. Sp. 1061, var. *decumbens* Meyer, Chloris Hannov. 667, *teste* Milde, Monogr. Equiset. 36; P.C. 138; L.P. 55.—"Meadows in dark damp valleys forming the outlet of meres."

Cap. CXXI (CXXII, N.K.): HIBERIS Diosc. II, ccv.

185. *Nasturtium-agreste*, Gauchbluom, 325; N.K. t. clxxxiii. *Hiberis*, Im. 185.—Br. 77. *Nasturtium pratense magno flore* C.B.P. 104. *Cardamine pratensis* L. Sp. 656.—"In uncultivated places [Diosc.], meadows, gardens, and waysides."

Cap. CXXII (CXXIII, N.K.): HIPPOSELINUM Diosc. III, lxxi (lxxviii).

186. *Hipposelinum* (*Olus atrum*), Grosz Epffich, 327; N.K. t. clxxxiv Im. 186.—*Hipposelinum Theophrasti vel Smyrnium, Dioscoridis* C.B.P. 154. *Smyrnium Olusatrum* L. Sp. 262.—"In shady places and by swamps [Diosc.]; planted in gardens in Germany."

Cap. CXXIII (CXXIV, N.K.): IXOS Diosc. III, xciii (ciii).

187. *Viscum*, Mistel, 329; N.K. t. clxxxv; Im. 187.—*Viscum baccis albis* C.B.P. 423. *Viscum album* L. Sp. 1023; P.C. 188; L.P. 162.—"On trees, especially oak, pear, and apple."

Cap. CXXIV (CXXV. N.K.) : Isatis Diosc. II, ccxv.

188. *Isatis sativa*, Weydt, 331 ; N.K. t. clxxxvi ; Im. 188.—*Isatis sativa vel latifolia* C.B.P. 113. *Isatis tinctoria* L. Sp. 670, var. *sativa* DC. Syst. ii. 570.—" Planted in many places in Germany, especially round Aach and Erfurt. Used for dyeing wool and cloths blue."

189. *Isatis sylvestris*, Wild Weydt, 332 ; N.K. t. clxxxvii ; Im. 189.—*Isatis sylvestris vel angustifolia* C.B.P. 113. *Isatis tinctoria* L. Sp 670, var. *vulgaris* Koch, Syn. ed. 1, 76.—" Spontaneous in certain places in Germany, as at Tübingen, where all the vineyard walls are clothed with it."

Cap. CXXV (CXXVI, N.K.) : Itea Diosc. I, cxxxv (cxxxvi).

190. *Primum salicis genus*, Rot Weiden, 334 ; N.K. t. clxxxviii. *Alterum salicis genus*, Im. 191.—*Salix purpurea* L. Sp. 1017 ; L.P. 174.—For this identification and the two following we are indebted to Mr. John Fraser, V.M.H., F.L.S.—" By water, and in moist places."

191. *Alterum salicis genus*, Geel Weiden, 335 ; N.K. t. clxxxix. *Primum salicis genus*, Im. 190.—*Salix sativa luteo folio crenato* C.B.P. 473. *Salix vitellina* L. Sp. 1016.—" By water, and in moist places."

192. *Tertium salicis genus*, Klein Weiden, 336 ; N.K. t. cxc ; Im. 192.—*Salix repens* L., var. *rosmarinifolia* (L.) Wimmer et Grab. Fl. Siles. ii. 380.—" By water, and in moist places."

Cap. CXXVI (CXXVII, N.K.) : Capnos Diosc. IV, cviii (cx).

193. *Fumaria* (*Fumus terræ*), 338 ; N.K. t. cxci : Im. 193.—Br. 27. *Fumaria officinarum et Dioscoridis* C.B.P. 143. *Fumaria officinalis* L. Sp. 700 ; P.C. 110 ; L.P. 121.—" In barley and flax fields, gardens, and vineyards, and by hedges and walls and in other rich uncultivated soil."

Cap. CXXVII (CXXVIII, N.K.) : Cici Diosc. IV, clxi (clxiv).

194. *Ricinus*, Wunderbaum, 340 ; N.K. t. cxcii ; Im. 194.—Br. 280. *Ricinus vulgaris* C.B.P. 432. *Ricinus communis* L. Sp. 1007 ; P.C. 59.—" A foreign plant, recently introduced into Germany, now sown almost everywhere in gardens."

Cap. CXXVIII (CXXIX, N.K.) : Cirsium Diosc. IV, cxvii (cxix).

195. *Cirsium germanicum*, Teütsch Ochsenzung, Klein O., 342 ; N.K. cxciii. *Cirsion*, N.H. cap. CXXIX. *Echium lanuginosum primum*, Im. 152.—Br. 35. *Anchusa officinalis* L. Sp. 133.—" In gardens, and spontaneously in sand around Nuremberg and Tübingen."

196. *Cirsium italicum*, Welsch Ochsenzung, Grosz O., 343 ; N.K. t. cxciv. *Buglossum magnum*, N. H. cap. CXXIX. *Echium italicum spinosum*, Im. 151. —*Anchusa azurea* Mill. (*A. italica* Retz.).—" Introduced from abroad a short time ago, now planted almost everywhere in gardens."

Cap. CXXIX (CXXX, N.K.) : CORIANNON Diosc. III, lxiv (lxxi).

197. *Coriandrum*, Coriander, 345 ; N.K. t. cxcv ; Im. 195.—Br. 70. *Coriandrum majus* C.B.P. 158. *Coriandrum sativum* L. Sp. 256 ; P.C. 81 ; L.P. 140.—" Everywhere spontaneous in Germany. Likes rich ground, according to Palladius, but also grows in poor soil."

Cap. CXXX (CXXXI, N.K.) : CASSUTHA auct. Græc. recentior. *ex* Fuchs.

198. *Cassutha* (*Cuscuta, Podagra lini*), Flachsz Seiden, Filtzkraut, Dotter, 348 ; N.K. t. cxcvi ; Im. 196.—*Cuscuta Epilinum* Weihe in Archiv Apoth. viii. 54 (1824).—" Grows not on the soil, but on herbs and shrubs. Has no root."

Cap. CXXXI (CXXXII, N.K.) : CESTRON Diosc. IV, i.

199. *Betonica*, Betonick, Bethonien, 350 ; N.K. t. cxcvii ; Im. 197.—Br. 23. *Betonica purpurea* C.B.P. 235. *Betonica officinalis* L. Sp. 573. *Stachys officinalis* Trevisan ; P.C. 304 ; L.P. 211.—" In meadows, woods, and mountainous, cold and dark places. A white-flowered form grows in some woods, and in particular in many places round Rotenburg am Neckar."

Cap. CXXXII (CXXXIII, N.K.) : BETONICA ALTERA Diosc. IV, ii ;
Paulus Æginetes, VII, sect. iii.

200. *Betonica* [*-altera*] *sylvestris una*, Dondernegele, 352 ; N.K. t. cxcviii ; Im. 199.—Br. 121. *Caryophyllus sylvestris vulgaris latifolius* C.B.P. 209. *Dianthus carthusianorum* L. Sp. 409.—" In dry, sandy, grassy, uncultivated places."

201. *Betonica* [*-altera*] *sylvestris altera*, Wildnegele, 353 ; N.K. t. cxcix ; Im. 200.—*Dianthus superbus* L. Sp. ed. 2, 589.—" Spontaneous in some meadows, fields, and gardens."

202. *Betonica* [*-altera*] *altilis*, Negelbluom, 354 ; N.K. t. cc ; Im. 198.—*Caryophyllus altilis major* C.B.P. 207. *Dianthus Caryophyllus*, var. β, L. Sp. 410 ; L.P. 76.—" Grown everywhere by the maidens, generally planted in flower-pots and boxes."

Cap. CXXXIII (CXXXIV, N.K.) : COLCHICUM Diosc. IV, lxxxiv.

203. *Colchicum* (*Hermodactylus*), Zeitlosen, 356 ; N.K. cci ; Im. 201.—Br. 176, 195, 243. *Colchicum commune* C.B.P. 67. *Colchicum autumnale* L. Sp. 341 (autumn state) ; P.C. 76 ; L.P. 258.—" Everywhere in meadows in Germany, and there is hardly a herb that grows in such great quantity as this. The naked flowers appear in late autumn, the leaves emerge from the soil in early spring, and the seed is mature in June."

204. *Colchici folia et semen*, 357 ; N.K. t. ccii ; Im. 202.—*Colchicum commune* C.B.P. 67. *Colchicum autumnale* L. Sp. 341 (summer state).

Cap. CXXXIV (CXXXV, N.K.) : CLEMATIS DAPHNOIDES Diosc. IV, vii.

205. *Clematis-daphnoides*, Syngruen, Yngruen, 360 ; N.K. t. cciii ; Im.

—Br. 62. *Clematis daphnoides minor* C.B.P. 301. *Vinca minor* L. Sp. 209; L.P. 132.—" In rich shady places, in some orchards, behind fences, under hedges, and on rocks."

Cap. CXXXV (CXXXVI, N.K.): CARDAMON Diosc. II, clxxxiv (clxxxv).

206. *Nasturtium-hortense* (*Nasturtium sativum*, *Cressio hortensis*), Gartenkresz, 362; N.K. t. cciv; Im. 204.—Br. 134, 252. *Nasturtium hortense vulgatum* C.B.P. 103. *Lepidium sativum* L. Sp. 644.—" Everywhere sown in gardens."

Cap. CXXXVI (CXXXVII, N.K.): CRINON Diosc. III, cvi (cxvi);
Plin. XXI, v. 11.

207. *Lilium* (*Lilium album*), Weisz Gilgen, 364; N.K. t. ccv; Im. 206.—Br. 229. *Lilium album flore erecto et vulgare* C.B.P. 76. *Lilium candidum* L. Sp. 302; P.C. 185; L.P. 218.—" Planted in almost all gardens."—Identified by Fuchs from Pliny's description.

208. *Lilium croceum*, Goldtgilg, 365; N.K. t. ccvi. *Lilium rubens*, Im. 208. —Br. 150. *Lilium croceum* Chaix.—" Not so common as the preceding, but cultivated as an ornamental plant in many places in Germany, as at Strasburg."

Cap. CXXXVII (CXXXVIII, N.K.): CUCURBITA SATIVA Diosc.
II, clxi (clxii); Plin. XIX, v 24.

209. *Cucurbita maior*, Grosz Kürbsz, 368; N.K. t. ccvii; Im. 209.—*Cucurbita major sessilis flore albo* C.B.P. 312; Moris. Hist. sect. 1, t. 5, fig. 2. *Cucurbita lagenaria* L. Sp. 1010. *Lagenaria vulgaris* Ser., var. *turbinata* Ser. in DC. Prodr. iii. 299.—" Must be raised from seed each year. Sown in April, flowers in June, fruit not mature until late autumn."

210. *Cucurbita minor*, Klein Kürbsz, 369; N.K. t. ccviii: Im. 210.—*Cucurbita lagenaria flore albo folio molli* C.B.P. 313; Moris. Hist. sect. 1, t. 5, fig. 1. *Cucurbita lagenaria* L. Sp. 1010. *Lagenaria vulgaris* Ser., var. *Gourda* Ser. in DC. Prodr. iii. 299.—Same remarks as No. 209.

211. *Cucurbita oblonga*, Lang Kürbsz, 370; N.K. t. ccix; Im. 211.—*Cucurbita oblonga flore albo, folio molli* C.B.P. 313; Moris. Hist. sect. 1, t. 5, fig. 3. *Cucurbita lagenaria* L. Sp. 1010. *Lagenaria vulgaris* Ser., var. *clavata* Ser. in DC. in Prodr. iii. 299.—Same remarks as No. 209.

Cap. CXXXVIII (CXXXIX, N.K.): COLOCYNTHIS Diosc.
IV, clxxv (clxxviii).

212. *Colocynthis*, Coloquint, 372; N.K. t. ccx; Im. 212.—*Cucumis Colocynthis* L. Sp. 1011. *Citrullus Colocynthis* Schrad.; P.C. 29.—" Raised from seed and rarely attains perfection, because the soil is too cold."

Cap. CXXXIX (CXL, N.K.): COTONEA MALUS Diosc. I, clx.

213. *Cotonea-malus* (*Cydonia*), Küttenbaum, 374; N.K. t. ccxi; Im. 213.—*Mala cotonea minora* C.B.P. 434. *Pyrus Cydonia*, var. γ, L. Sp. 480. *Cydonia*

oblonga Mill.; P.C. 233; L.P. 90.—"Planted in gardens. Prefers cold damp situations."

Cap. CXL (CXLI, N.K.): CASTANEA Diosc. I, cxlv.

214. *Castanea*, Kesten, 377; N.K. t. ccxii; Im. 214.—*Castanea sylvestris* C.B.P. 419. *Fagus Castanea* L. Sp. 997. *Castanea sativa* Mill.; P.C. 67; L.P. 87.—"Likes shady situations with a northern exposure."

Cap. CXLI (CXLII, N.K.): CARYON BASILICON Diosc. I, clxxviii.

215. *Juglans*, Welschnusz, 379; N.K. t. ccxiii; Im. 215.—*Nux juglans sive regia vulgaris* C.B.P. 417. *Juglans regia* L. Sp. 997; L.P. 92.—"In almost all gardens in Germany."

Cap. CXLII (CXLIII, N.K.): CALTHA Plin. XXI, vi. 15.

216. *Caltha* (*Calendula*), Ringelbluom, 382; N.K. t. ccxiv; Im. 216.—Br. 89. *Caltha vulgaris* C.B.P. 275. *Calendula officinalis* L. Sp. 921; P.C. 180; L.P. 180.—"Almost everywhere in gardens."

Cap. CXLIII (CXLIV, N.K.): CARYOPHYLLATA auct. Lat. recentior. *ex* Fuchs.

217. *Caryophyllata hortensis* (*Herba Benedicta*), Garten Benedictenwurtz, 384; N.K. t. ccxv; Im. 217.—Br. 111. *Caryophyllata vulgaris* C.B.P. 321. *Geum urbanum* L. Sp. 501; P.C. 17; L.P. 99.—"Planted in gardens. Flower pale-yellow."

218. *Caryophyllata sylvestris*, Wild Benedictenwurtz, 385; N.K. t. ccxvi; Im. 218.—*Geum intermedium* Ehrh. × *G. urbanum* L.—"Almost everywhere in shady places by fences and hedges. Flower saffron-yellow."—The somewhat drooping flowers, and the larger size and deeper colour of the petals indicate a strain of *G. rivale*. Fuchs's plant, however, is not true *G. intermedium* (*rivale* × *urbanum*), but a back cross of *intermedium* with *urbanum*.

Cap. CXLIV (CXLV, N.K.): CENTAURIUM MINUS Diosc. III, vii (ix).

219. *Centaurium minus* (*Centauria minor*), Klein Tausendtgulden, 387; N.K. t. ccxvii; Im. 219.—*Centaurium minus* C.B.P. 378. *Gentiana Centaurium* L. Sp. 229. *Centaurium umbellatum* Gilib.; P.C. 63; L.P. 116.—"Although Dioscorides writes that it grows in wet and damp places, yet everyone knows that with us it commonly grows in hard dry grassy fields and meadows."

Cap. CXLV (CXLVI, N.K.): CYAMOS Diosc. II, cxxvii.

220. *Faba*, Bonen, 389; N.K. t. ccxviii. *Faba vulgaris*, Im. 220.—Br. 222. *Faba* C.B.P. 338. *Vicia Faba* L. Sp. 737; L.P. 65.—"Everywhere planted in gardens. Likes rich soil."

Cap. CXLVI (CXLVII, N.K.): CONSOLIDA MEDIA herbariorum *ex* Fuchs.

221. *Consolida media*, Gulde Guntzel, 391; N.K. t. ccxix. *Consolida-media purpurea*, Im. 221.—*Consolida media pratensis cærulea* C.B.P. 260. *Ajuga reptans* L. Sp. 561; P.C. 42.—"In meadows, and in grassy fields at high levels."

Cap. CXLVII (CXLVIII, N.K.) : CANNABIS Diosc. III, clv (clxv).

222. *Cannabis sativa,* Zamer Hanff, 393 ; N.K. t. ccxx ; Im. 222.—Br. 209. *Cannabis sativa* L. Sp. 1027 ; P.C. 142.—" Sown in gardens. Is of two kinds, male and female. The male bears seed, but the female has none. Both kinds are produced from the same lot of seed."—A composite figure, the lower part being represented as " male " (female) and the upper as " female " (male).

Cap. CXLVIII (CXLIX, N.K.) : CARDIACA herbariorum *ex* Fuchs.

223. *Cardiaca,* Hertzgspan, Hertzgesperr, 395 ; N.K. t. ccxxi ; Im. 223.—Br. 54. *Marrubium Cardiaca dictum* C.B.P. 230. *Leonurus Cardiaca* L. Sp. 584 ; P.C. 189.—" Almost everywhere by fences, hedges, and old walls."

Cap. CXLIX (CL, N.K.) : CARON Diosc. III, lix (lxvi)

224. *Caros,* Feldkümich, Wisenkümel, 396 ; N.K. t. ccxxii. *Careum,* Im. 224.—*Carum Carvi* L. Sp. 263 ; P.C. 55 ; L.P. 137 —" Everywhere in dry meadows."

Cap. CL (CLI, N.K.) : CARYON PONTICUM Diosc. I, clxxix.

225. *Avellana-nux sylvestris* (*Corylus*), Haselnusz, 398 ; N.K. t. ccxxiii ; Im. 225.—*Corylus sylvestris* C.B.P. 418. *Corylus Avellana* L. Sp 998 ; L.P. 87.—" Everywhere in woods, on mountains, and in hedges."

226. *Avellana domestica,* Rotnusz, 399 ; N.K. t. ccxxiv , Im. 226.- *Corylus sativa fructu albo minore sive vulgaris* C.B.P. 417. *Corylus Avellana,* var. β, L. Sp 999. *Corylus maxima* Mill. Gard. Dict. ed. 8, n. 2 (1768).—" In gardens."

Cap. CLI (CLII, N.K.) : CENTUMMORBIA vulgo *ex* Fuchs.

227. *Centummorbia* (*Nummularia*), Egelkraut, 401 ; N.K. t. ccxxv ; Im. 227.—*Lysimachia Nummularia* L. Sp. 148.—" In damp meadows, orchards, borders of fields, and grassy woods."

Cap. CLII (CLIII, N.K.) : COCCIMELEA Diosc. I, clxxiv.

228. *Prunus sativa,* Pflaumenbaum, 403 ; N.K. t. ccxxvi ; Im. 228.—*Prunus* C.B.P. 443. *Prunus domestica* L. Sp. 475.—" In gardens."

229. *Prunus sylvestris,* Schlehen, 404 ; N.K. t ccxxvii ; Im. 229.—Br. 258. *Prunus sylvestris* C.B.P. 444. *Prunus spinosa* L. Sp. 475.—" In almost all hedges."

Cap. CLIII (CLIV, N.K.) : CONIUM Diosc. IV, lxxix.

230. *Cicuta* (*Conion*), Wueterich, 406 ; N.K. t. ccxxviii ; Im. 230.—*Cicuta major* C.B.P. 160. *Conium maculatum* L. Sp. 243 ; P.C. 130 ; L.P. 253.—" In uncultivated ground, behind fences, and in cool and shady places."

Cap. CLIV (CLV, N.K.) : CYNOGLOSSUM OFFICINARUM Fuchs.

231. *Cynoglossum-officinarum,* Hundszzung, 408 ; N.K. t. ccxxix. *Lycopsis,* Falsche Hundszzung, Im. 264.—Br. 34. *Buglossum sylvestre tertium* C.B.P.

256. *Echium vulgare* L. Sp. 139 ; P.C. 43.—" Everywhere in fields, especially by the wayside." " Flowers first purple, then blue. Threads inside them purple."—A branched condition of the Viper's Bugloss, probably a basal shoot developed in consequence of injury to the main stem.

Cap. CLV (CLVI, N.K.) : CNICUS Diosc. IV, clxxxvii (cxc).

232. *Cartamus* (*Crocus hortensis*), Wilder Gartensaffran, 409 ; N.K. t. ccxxx ; Im. 231.—Br. 196, 282. *Cnicus sativus sive Carthamum officinarum* C.B.P. 378. *Carthamus tinctorius* L. Sp. 830 ; P.C. 242.—" Planted in gardens and fields in many parts of Germany. Used for colouring food yellow."

Cap. CLVI (CLVII, N.K.) : CENCHRUS Diosc. II, cxix.

233. *Milium*, Hirsz, 411 ; N.K. t. ccxxxi ; Im. 232.—Br. 225. *Milium semine luteo vel albo* C.B.P. 26. *Panicum miliaceum* L. Sp. 58.—" Cultivated almost everywhere."

Cap. CLVII (CLVIII, N.K.) : CRAMBE SATIVA, Diosc. II, cxlvi.

234. *Brassicæ primum genus* (*Brassica levis*), Breiter Koel, 413 ; N.K. t. ccxxxii ; Im. 233.—*Brassica oleracea* L., var. *acephala* DC. Syst. ii. 583, subvar. *viridis* (L. Sp. 667) O. E. Schulz in Engl. Pflanzenr., Crucif.-Brassic. i. 30.—" Everywhere in gardens."

235. *Brassicæ secundum genus* (*Brassica Apiana*), Krauser Koel, 414 ; N.K. t. ccxxxiii ; Im. 234.—*Brassica fimbriata* C.B.P. 112. *Brassica oleracea* var. *acephala* subvar. *sabellica* (L. Sp. 667) O. E. Schulz, l. c.—" Everywhere in gardens."

236. *Brassicæ tertium genus* (*Crambe*), Kleiner Koel, 415 ; N.K. t. ccxxxiv ; Im. 235.—*Brassica Napus* L. Sp. 666 ; O. E. Schulz, l. c. 39.—" Everywhere in gardens."

237. *Brassicæ quartum genus* (*Brassica capitata*), Kappiszkraut, 416 ; N.K. t. ccxxxv ; Im. 236.—Br. 216. *Brassica capitata alba* C.B.P. 111. *Brassica oleracea*, var. *capitata* L. Sp. 667 ; O. E. Schulz, l. c. 30. " Everywhere in gardens."

Cap. CLVIII (CLIX, N.K.) : CRUCIATA Fuchs.

238. *Cruciata*, Madelgeer, Creützwurtz, 420 ; N.K. t. ccxxxvi. *Gentianæ species*, Im. 112.—Br. 115. *Gentiana cruciata* C.B.P. 188. *Gentiana Cruciata* L. Sp. 231.—" In uncultivated places."

Cap. CLIX (CLX, N.K.) : CISSOS Diosc. II, ccx.

239. *Hedera nigra*, Maur Ephew, 422 ; N.K. t. ccxxxvii ; Im. 237.—Br. 92, 93. *Hedera arborea* C.B.P. 305. *Hedera Helix* L. Sp. 202 ; P.C. 145 ; L.P. 218.—" Everywhere on walls."

240. *Hedera Helix*, Klein Ephew, 423 ; N.K. t. ccxxxviii ; Im. 238.—*Hedera major sterilis* C.B.P. 305. *Hedera Helix*, var. γ, L. Sp. 202.—" Creeps on the ground in woods under shrubs.

Cap. CLX (CLXI, N.K.): Cerasus Diosc. I, clvii.

241. *Cerasus*, Kirschen, 425; N.K. t. ccxxxix; Im. 240.—*Prunus avium* L. Sp. ed. 2, 680; P.C. 67.—"Cultivated in all gardens, also found in woods, especially on well-watered mountains."—Fuchs described three kinds of cherry, namely, "Amarellen" (*Prunus Cerasus*, var. *Capromana* L.), "Weichsel" (*P. Cerasus* var. *austera* L.) and "Kirschen" proper (*P. avium* L.), and gave a single figure (of *P. avium*) to represent all three.

Cap. CLXI (CLXII, N.K.): Cyanus Plin. XXI, viii. 24.

242. *Cyanus* (*Flos frumentorum*), Blaw Kornbluomen, 428; N.K. t. ccxl. *Cyanus sylvestris*, Im. 241. Br. 201. *Cyanus segetum* C.B.P. 273. *Centaurea Cyanus* L. Sp. 911; P.C. 82.—"Common everywhere in corn. A blue paint is made by boys down to the present day, by crushing the petals in white of egg."

Cap. CLXII (CLXIII, N.K.): Crommyon Diosc. II, clxxx (clxxxi).

243. *Cepa*, Zwibel, 430; N.K. t. ccxli; Im. 242.—Br. 247. *Cepa vulgaris* C.B.P. 71. *Allium Cepa* L. Sp. 300; P.C. 202; L.P. 59.—"Planted everywhere in gardens."

Cap. CLXIII (CLXIV, N.K.): Campanula Fuchs.

244 *Campanula*, Halszkraut, 432; N.K. t. ccxlii. *Campanula maior*, Im. 243.—*Campanula vulgatior foliis urticæ vel major et asperior* C.B.P. 94. *Campanula Trachelium* L. Sp. 166.—"In bushy places by dry meadows."

Cap. CLXIV (CLXV, N.K.): Calamintha Diosc. III, xxxvii (xliii).

245. *Calaminthæ primum genus* (*Calamintha montana*), Katzenmüntz, 434; N.K. t. ccxliii; Im. 244.—Br. 275. *Mentha cataria vulgaris et major* C.B.P. 228. *Nepeta Cataria* L. Sp. 570; P.C. 61; L.P. 175.—"In rough and stony places, especially on mountains."

246. *Calaminthæ secundum genus* (*Nepeta, Pulegium sylvestre*), Wilder Poley, 435; N.K. t. ccxliv; Im. 245.—*Calamintha arvensis verticillata* C.B.P. 229. *Mentha arvensis* L. Sp. 577.—"On heaths and fields."

247. *Calaminthæ tertium genus*, Geele Müntz, 436; N.K. t. ccxlv; Im. 246. *Conyza media Asteris flore luteo* C.B.P. 265. *Inula dysenterica* L. Sp. 882. *Pulicaria dysenterica* Bernh.—"In watery places, and sometimes behind hedges."

Cap. CLXV (CLXVI, N.K.): Crithe Diosc. II, cviii.

248. *Hordeum polystichum*, Grosse Gerst, 438; N.K. t. ccxlvi; Im. 247.—*Hordeum tetrastichum* Stokes.—"Likes rich soil."

249. *Hordeum distichum*, Kleine Gerst, 439; N.K. t. ccxlvii; Im. 248.—*Hordeum distichon* C.B.P. 23. *Hordeum distichon* L. Sp. 85; P.C. 21.—"Likes rich soil."

Cap. CLXVI (CLXVII, N.K.): Crocus Diosc. I, xxv.

250. *Croci flores et folia*, Saffran, 411; N.K. t. ccxlviii; Im. 249.—*Crocus sativus* C.B.P. 65. *Crocus sativus*, var. *officinalis* L. Sp. 36; P.C. 243; L.P. 184.—" Planted in many places in Germany."

Cap. CLXVII (CLXVIII, N.K.): Cynocrambe Diosc. IV, clxxxix (cxcii).

251. *Cynocrambe* (*Mercurialis sylvestris mas*), Wild Bingelkraut, 444; N.K. t. ccxlix. *Cynocrambe mas*, Im. 250.—*Mercurialis montana testiculata* C.B.P. 122. *Mercurialis perennis* L. Sp. 1035 (female plant !).—" Abundant in woods. Also found on high mountains, beside fences and hedges."

Cap. CLXVIII (CLXIX, N.K.): Colytea Theophr. III, xiv. 4.

252. *Colytea*, Welsch Linsen, 446; N.K. t. ccl. *Colutea*, Im. 251.—*Colutea vesicaria* C.B.P. 396. *Colutea arborescens* L. Sp. 723; L.P. 5.—" Planted in gardens."

253. *Sena*, Senet, 447; N.K. t. ccli; Im. 252.—*Senna Italica sive foliis obtusis* C.B.P. 397. *Cassia Senna*, var. *β*, L. Sp. 377. *Cassia obovata* Colladon, Hist. Casses, 92 (1816).—" Planted in gardens."

Cap. CLXIX (CLXX, N.K.): Coronopus Diosc. II, clvii (clviii).

254. *Coronopus* (*Cornu-cervium*), Kraeenfuosz, 449; N.K. t. cclii; Im. 253.—*Coronopus hortensis* C.B.P. 190. *Plantago Coronopus*, var. *β*, L. Sp. 115.—" Does not occur anywhere in Germany, as far as I know, except when planted in gardens."

Cap. CLXX (CLXXI, N.K.): Cyclaminus Diosc. II. cxciii (cxciv).

255. *Cyclaminus* (*Cyclamen*), Schweinbrot, 451; N.K. t. ccliii. *Cyclaminus rotunda*, Im. 254.—*Cyclamen europæum* L. Sp. 145.—" In shady places, under hedges and trees. Quite scarce in some localities."

Cap. CLXXI (CLXXII, N.K.): Cyperus Diosc. I, iv.

256. *Cyperus*, Wilder Galgan, 453; N.K. t. ccliv; Im. 255.—*Cyperus odoratus radice longa: sive Cyperus Officinarum* C.B.P. 14. *Cyperus longus* L. Sp. 45.—" Not spontaneous in Germany. Must be planted in gardens, as I have done with the plant here figured."

Cap. CLXXII (CLXXIII, N.K.): Lathyris Diosc. IV, clxiv (clxvii).

257. *Lathyris*, Springkraut, 455; N.K. t. cclv.; Im. 256.—Br. 239. *Lathyris major* C.B.P. 293. *Euphorbia Lathyris* L. Sp. 457.—" Likes sandy cultivated ground. Grows in almost all gardens."

Cap. CLXXIII (CLXXIV, N.K.): Leucoïon Diosc. III, cxxviii (cxxxviii).

258. *Leucoion* (*Viola alba*), Weisz Veiel, 457; N.K. t. cclvii. *Leucoion-Dioscoridis album*, Im. 257.—*Hesperis hortensis* C.B.P. 202. *Hesperis matronalis* L. Sp. 663, var. *hortensis*, subvar. *albiflora* DC. Syst. Veg. ii. 450.—" Planted in gardens, and never spontaneous. Does not differ from the purple kind, except in the flowers."

259. *Viola-lutea*, Geel Veiel, 458; N.K. t. cclvi. *Leucoion-Dioscoridis luteum*, Im. 258.—Br. 43. *Leucoium luteum vulgare* C.B.P. 202. *Cheiranthus Cheiri* L. Sp. 661.—" Planted in gardens. Grows spontaneously on walls in some places."

260. *Viola-purpurea*, Braun Veiel, 459; N.K. t. cclviii. *Leucoion-Dioscoridis purpureum*, Im. 259.—*Hesperis hortensis* C.B.P. 202. *Hesperis matronalis* L. Sp. 663, var. *hortensis*, subvar. *purpurea* DC. Syst. Veg. ii. 450.—" Planted in gardens, and never spontaneous."

Cap. CLXXIV (CLXXV, N.K.) : LAPATHUM Diosc. II, cxl.

261. *Oxylapathum* (*Lapatium acutum*), Mengelwurtz, 461; N.K. t. cclix; Im. 260.—Br. 164. Apparently *Rumex obtusifolius* L. Sp. 335.—" Spontaneous in damp gardens, lakes, swamps, and ditches."

262. *Rumicis secundum genus* (*Rhabarbarum monachorum*), Munch Rhabarbarum, 462; N.K. t. cclx; Im. 261.—Br. 198. *Hippolapathum latifolium* C.B.P. 115. *Rumex alpinus* L. Sp. 334.—" To-day cultivated in many gardens." After comparison with the much better figure in Fuchs, I now refer *Rhabarbarum* Brunf. to this species.—T. A. S.

263. *Rumicis tertium genus* (*Bonus Henrichus*), Guoter Heinrich, 263: N.K. t. cclxi; Im. 262. Br. 15. *Lapathum unctuosum* C.B.P. 115. *Chenopodium Bonus-Henricus* L. Sp. 218. —" Everywhere in uncultivated places in villages, behind fences, in old homesteads, and by waysides."

264. *Oxalis* (*Acetosa*), Saur Ampffer, 464; N.K. t. cclxii; Im. 263.—Br. 128. *Acetosa pratensis* C.B.P. 114. *Rumex Acetosa* L. Sp. 337; P.C. 265. —" In all meadows and orchards."

Cap. CLXXV (CLXXVI, N.K.) : LIMONIUM Diosc. IV, xvi.

265. *Limonium* (*Pyrola*), Wintergruen, 467; N.K. t. cclxiii; Im. 265.—Br. 165. *Pyrola rotundifolia major* C.B.P. 191. *Pyrola rotundifolia* L. Sp. 396. —" In shady uncultivated places, especially in woods."

Cap. CLXXVI (CLXXVII, N.K.) : LAMIUM Plin. XXI, xv. 55; XXII, xiv. 16.

266. *Lamium* (*Urtica alba*), Taubnessel, 469; N.K. t. cclxiv. *Lamii tria genera*, Im. 266.—*Lamium album* L. Sp. 579; P.C. 12; L.P. 108.—" Everywhere by waysides and fences."—Fuchs recognised three species of *Lamium*: with white, yellow, and purple flowers respectively. These were *L. album* L., *Galeobdolon luteum* Huds., and *L. maculatum* L. As they seemed to him to differ in nothing but the colour of the flowers, he gave one picture (of *L. album*) to represent all three.

Cap. CLXXVII (CLXXVIII, N.K.) : LINUM Diosc. II, cxxv.

267. *Linum*, Flachsz, 471; N.K. t. cclxv; Im. 267.—Br. 59. *Linum sativum* C.B.P. 214. *Linum usitatissimum*, var. *β*, L. Sp. 277; P.C. 166; L.P. 16.—" Cultivated almost everywhere in Germany in fields and gardens."

Cap. CLXXVIII (CLXXIX, N.K.): LICHEN Diosc. IV, liii.

268. *Lichen* (*Hepatica*), Stein Leberkraut, Brunnenleberkraut, 473; N.K. t. cclxvi; Im. 268.—Br. 69. *Lichen petræus latifolius sive Hepatica fontana* C.B.P. 362. *Marchantia polymorpha* L. Sp. 1137.—"On dripping strong-smelling rocks and stones and in deep cold streams."

Cap. CLXXIX (CLXXX, N.K.): LINOZOSTIS Diosc. IV, clxxxviii.

269. *Mercurialis mas*, Bingelkraut mennle, 475; N.K. t. cclxvii; Im. 269. —*Mercurialis testiculata, sive mas* C.B.P. 121. *Mercurialis annua* L. Sp. 1035 (female plant!); L.P. 12.—"Found in cultivated fields and vineyards. Planted in gardens. Sows itself annually and is difficult to extirpate when once introduced." "The two kinds differ particularly only in the seed. However, the leaves of the male [*i. e.*, female] plant are somewhat darker than those of the female [*i. e.*, male]."

270. *Mercurialis fœmina*, Bingelkraut weible, 476; N.K. t. cclxviii; Im. 270.—*Mercurialis spicata sive fœmina* C.B.P. 121. *Mercurialis annua* L. Sp. 1035 (male plant!).—Habitat as in No. 269.

Cap. CLXXX (CLXXXI, N.K.): LIBANOTIS CORONARIA Diosc. III, lxxxix.

271. *Rosmarinus*, Roszmarin, 478; N.K. t. cclxix; Im. 271.—Br. 122. *Rosmarinus hortensis angustiore folio* C.B.P. 217. *Rosmarinus officinalis*, var. *β*, L. Sp. 23; P.C. 240; L.P. 146.—"Grown in gardens and pots in Germany. Very abundant in Dauphiné and Languedoc, so that the inhabitants use it as their sole source of firewood."

Cap. CLXXXI (CLXXXII, N.K.): LIGUSTRUM Plin. XXIV, x. 45.

272. *Ligustrum*, Beinhoeltzlin, 480; N.K. t. cclxx; Im. 272.—*Ligustrum germanicum* C.B.P. 475. *Ligustrum vulgare* L. Sp. 7; L.P. 111.—"Common in all hedges in Germany."

Cap. CLXXXII (CLXXXIII, N.K.): LUNARIA MINOR vulgo *ex* Fuchs.

273. *Lunaria-minor*, Klein Monkraut, 482; N.K. t. cclxxi; Im. 273.—*Lunaria racemosa minor vel vulgaris* C.B.P. 354. *Osmunda Lunaria* L. Sp. 1064. *Botrychium Lunaria* Sw.—"Does not grow everywhere, but is scarce. Commonly found on grassy mountains, as on the Osterberg, near Tübingen, where it is extremely abundant."

Cap. CLXXXIII (CLXXXIV, N.K.): LEPIDIUM Diosc. II, ccv.

274. *Lepidium*, Pfefferkraut, 484; N.K. t. cclxxii. *Lepidium magnum*, Im. 274.—Br. 180. *Lepidium latifolium* C.B.P. 97. *Lepidium latifolium* L. Sp. 644.—"Planted in gardens. When once introduced it is difficult to extirpate."

Cap. CLXXXIV (CLXXXV, N.K.): LEUCOÏON Theophr. VII, xiii. 9.

275. *Viola-alba*, Hornungsbluom, Weisz Hornungsbluom, 486; N.K. t. cclxxiii. *Viola-alba Theophrasti*, Im. 275.—Br. 42. *Leucoium bulbosum*

vulgare C.B.P. 55. *Leucojum vernum* L. Sp. 289 (flowering).—According to Dyer in Hort, Theophr. ii. 462, *Leucoïon* Theophr. is *Galanthus nivalis* L.—"Likes shady dark places and woods, especially beside water. Abundant above the monastery of Bebenhausen near Tübingen."

276. *Violæ-albæ folio cum semine*, Weisz Hornungsbluom mit dem samen, 487 ; N.K. t. cclxxiv. *Violæ albæ Theophrasti folio cum semine*, Im. 276.—*Leucojum vernum* L. Sp. 289 (fruiting).—The shape of the fruit distinguishes it from *L. æstivum* L.

Cap. CLXXXV (CLXXXVI, N.K.) : LITHOSPERMUM Diosc. III, cxlviii (clviii).

277. *Lithospermum*, Meerhirsz, 489 ; N.K. t. cclxxv. *Lithospermum sativum*, Im. 277.—*Lithospermum majus erectum* C.B.P. 258. *Lithospermum officinale* L. Sp. 132.—"Commonly cultivated in gardens, although it also occurs spontaneously in some rough places."

Cap. CLXXXVI (CLXXXVII, N.K) : LYSIMACHIA Diosc. IV, iii.
LYSIMACHIA Plin. XXV, vii. 35.

278. *Lysimachia purpurea*, Rot Weiderich, Braun Weiderich, 491 ; N.K. t. cclxxvii ; Im. 279.—*Lysimachia siliquosa hirsuta magno flore* C.B.P. 245. *Epilobium hirsutum* L. Sp. 347.—"In marshy places, and beside water, where willows grow." The habitat "in marshy places and beside water" is taken from Dioscorides.

279. *Lysimachia lutea*, Geel Weiderich 492 ; N.K. t cclxxviii ; Im. 280.—*Lysimachia lutea major* C.B.P. 245. *Lysimachia vulgaris* L. Sp 146 ; P.C. 172.—Same habitat as No. 278.

Cap. CLXXXVII (CLXXXVIII, N.K.) : LAGOPUS Diosc. IV, xvii.

280. *Lagopus* (*Leporinus pes*, *Trifolium humile*), Katzenklee 494 ; N.K. t. cclxxix ; Im. 281.—*Trifolium arvense humile spicatum, sive Lagopus* C.B.P. 328. *Trifolium arvense* L. Sp. 769. Habitat "in cornfields and gardens" avowedly taken from Pliny and Dioscorides. Martens and Semler, Fl. Württemberg, ed. 2, 123 (1865), state that it grows in sandy fields and on dry hills.

Cap. CLXXXVIII (CLXXXIX, N.K.) : LARIX Diosc. I, xcii.

281. *Larix*, Loerchenbaum, 496 ; N.K. t. cclxxx ; Im. 282.—*Larix* C.B.P. 493. *Pinus Larix* L. Sp. 1001. *Larix decidua* Mill. ; P.C. 159.—"Does not occur everywhere. Very abundant in Silesia, where it is used for panelling rooms. The Marcgrave George of Brandenburg had many Larch trees brought to Onoltzbach and planted in his garden, and sent the one here illustrated to Tübingen for me."

Cap. CLXXXIX (CXC, N.K.) : MELISSOPHYLLUM Diosc. III, cviii (cxviii).

282. *Melissophyllum verum*, Melissen, 498 ; N.K. t. cclxxxi ; Im. 283.—*Lamium montanum Melissæ folio* C.B.P. 231. *Melittis Melissophyllum* L.

Sp. 597 ; L.P. 174.—" Does not grow everywhere. Found in woods near Ingolstadt and Onoltzbach, where I have seen it in abundance."

283. *Melissophyllum adulterinum*, Wantzenkraut, 499 ; N.K. t. cclxxxii. *Melissophyllum vulgare*, Im. 284.—Br. 158. *Melissa hortensis* C.B.P. 229. *Melissa officinalis* L. Sp. 592 ; P.C. 18 ; L.P. 167.—" Cultivated everywhere in gardens."

Cap. CXC (CXCI, N.K.) : MARATHRUM Diosc. III, lxxiv (lxxx).

284. *Fœniculum*, Fenchel, 501 ; N.K. t. cclxxxiii ; Im. 285.—Br. 97, 207, 284. *Fœniculum vulgare Germanicum* C.B.P. 147. *Anethum Fœniculum* L. Sp. 263. *Fœniculum vulgare* Mill. ; P.C. 102 ; L.P. 44, 138.—" Planted everywhere in gardens. Also occurs spontaneously in uncultivated places, like Dill."

Cap. CXCI (CXCII, N.K.) : MELANTHIUM Diosc. III, lxxxiii (xciii).

285. *Melanthium hortense primum*, Schwartz Kommich (Kümmich), 503 ; N.K. t. cclxxxiv ; Im. 286.—*Nigella flore minore simplici candido* C.B.P. 145. *Nigella sativa* L. Sp. 534.—" Planted in gardens."

286. *Nigella hortensis altera*, Schwartz Coriander, 504 ; N.K. t. cclxxxv. *Melanthium alterum Damascenum vocatum*, Im. 287.—*Nigella angustifolia flore majore simplici cæruleo* C.B.P. 145. *Nigella damascena* L. Sp. 534.—" Planted in gardens."

287. *Melanthium sylvestre*, Wilder schwartzer Coriander, 505 ; N.K. t. cclxxxvi. *Cuminum sylvestre alterum*, Im. 288.—*Nigella arvensis cornuta* C.B.P. 145. *Nigella arvensis* L. Sp. 534.—" Spontaneous in cornfields, *e.g.*, among rye, wheat, spelt, and barley."

Cap. CXCII (CXCIII, N.K.) : MALACHE Diosc. II, cxliv.

288. *Malva hortensis*, Ernrosen, 507 ; N.K. t. cclxxxvii ; Im. 289.—*Malva rosea folio subrotundo* C.B.P. 315. *Alcea rosea* L. Sp. 687. *Althæa rosea* Cav. ; P.C. 132.—" Cultivated in gardens."

289. *Malva sylvestris pumila*, Genszpappel, 508 ; N.K. t. cclxxxviii ; Im. 290.—Br. 131. *Malva sylvestris folio rotundo* C.B.P. 314. *Malva rotundifolia* L. Sp. 688.—" Almost everywhere in uncultivated soil, beside fences, and in gardens and churchyards."

290. *Malva sylvestris elatior*, Roszpappel, 509 ; N.K. t. cclxxxix ; Im. 291.—Br. 132. *Malva sylvestris folio sinuato* C.B.P. 314. *Malva sylvestris* L. Sp. 689 ; P.C. 35 ; L.P. 15.—Habitat as in No. 289. " Likes rich humid places."

Cap. CXCIII (CXCIV, N.K.) : MYRICE Diosc. I, cxvi.

291. *Tamarix* (*Tamarix sylvestris*), Tamarisck, 513 ; N.K. t. ccxc. *Tamarix sylvestris fœmina*, Im. 292.—*Tamarix fruticosa folio crassiore ; sive Germanica*

C.B.P. 485. *Tamarix germanica* L. Sp. 271. *Myricaria germanica* Desv.—"By rivers and pools in many places in Germany—namely, by the Rhine, Iser, and Lech."

Cap. CXCIV (CXCV, N.K.) : MECON RHŒAS Diosc. IV, lxiv.

292. *Papaver-erraticum primum*, Klapperrosen, 515; N.K. t. ccxci; Im. 293. —Br. 154. *Papaver erraticum majus* C.B.P. 171. *Papaver Rhœas* L. Sp. 507 ; P.C. 227 ; L.P. 190.—"In nearly all kinds of corn. Not so common as the next."

293. *Papaver-erraticum alterum*, Kornrosen, 516 : N.K. t. ccxcii ; Im. 294.—*Papaver erraticum minus* C.B.P. 171. *Papaver Rhœas*, var. β, L. Sp. 507. *Papaver intermedium* var. *erraticum* (Jord.) Rouy et Fouc. Fl. France, i. 155 (*P. Fuchsii* Timb.).—"In nearly all kinds of corn."

Cap. CXCV (CXCVI, N.K.) : MECON SATIVUS Diosc. IV, lxv.

294. *Papaver-sativum*, Magsomen, Magsamen, 518 : N.K. t. ccxciii. *Papaver-sativum purpureum et album*, Im. 295.—Br. 227. *Papaver hortensis semine albo* C.B.P. 170. *Papaver somniferum* L. Sp. 508 ; P.C. 226 ; L.P. 219.—"Sown in gardens."

Cap. CXCVI (CXCVII, N.K.) : MECON CERATITIS Diosc. IV, lxvi.

295. *Papaver-corniculatum*, Gelb (Geel) Oelmagen, 520 ; N.K. t. ccxciv. *Papaver-corniculatum luteum*, Im. 296 —*Papaver corniculatum luteum* C.B.P. 171. *Chelidonium Glaucium* L. Sp. 506. *Glaucium flavum* Crantz.—"Not spontaneous in Germany."

Cap. CXCVII (CXCVIII, N.K.) : MORUS Diosc. I, clxxx.

296. *Morus*, Maulbeerbaum, 522 ; N.K. t. ccxcv : Im. 297.—*Morus fructu nigro* C.B.P. 459. *Morus nigra* L. Sp. 986 ; P.C. 193.—"Likes warm and sandy places, and benefits from trenching and manuring."

Cap. CXCVIII (CXCIX, N.K.) : MYRRHIS Diosc. IV, cxiv (cxvi).

297. *Myrrhis* (*Cicutaria*), Wildkoerffel, Wilder Koerbel, 525 ; N.K. t. ccxcvi ; Im. 298.—*Myrrhis sylvestris seminibus lævibus* C.B.P. 160. *Chærophyllum sylvestre* L. Sp. 258. *Anthriscus sylvestris* Hoffm.—"Spontaneous in orchards and dry meadows."

Cap. CXCIX (CC, N.K.) : MELILOTUS Diosc. III, xli (xlviii).

298. *Melilotus germanica*, Unser Frawen Schuechlin, 527 ; N.K. t. ccxcvii. *Meliloti tertium genus*, Im. 299.—*Lotus sive Melilotus pentaphyllos minor glabra* C.B.P. 332. *Lotus corniculatus* L. Sp. 775.—"In all meadows, especially those on mountains."

299. *Melilotus italica*, Welscher Steinklee, 528 ; N.K. t. ccxcviii. *Meliloti quartum genus*, Im. 300.—*Melilotus corniculis reflexis major* C.B.P. 331. *Trifolium Melilotus corniculata* L. Sp. 766. *Trigonella corniculata* L. Sp. ed. 2, 1094.—"Cultivated in gardens, and as a pot plant."

Cap. CC (CCI, N.K.) : MANDRAGORA Diosc. IV, lxxvi.

300. *Mandragora mas*, Alraun mennle, 530 ; N.K. t. ccxcix ; Im. 301. *Mandragora fructu rotundo* C.B.P. 169. *Mandragora officinarum* L. Sp. 181.—" Likes woods and shady places. Now also planted in gardens."

Cap. CCI (CCII, N.K.) : MALA INSANA vulgo *ex* Fuchs.

301. *Mala-insana* (*Amoris-poma*), Melantzan, Melanzan, 533 ; N.K. t. ccc ; Im. 302.—*Solanum pomiferum fructu oblongo* C.B.P. 167. *Solanum Melongena* L. Sp. 186.—" A foreign plant, cultivated in gardens, and in flower-pots and hanging baskets outside windows. Likes the same treatment as cucumbers and melons."

Cap. CCII (CCIII, N.K. : NYMPHÆA Diosc. III, cxxxviii (cxlviii).

302. *Nymphæa candida*, Weisz Seebluomen, 535 ; N.K. t. ccci ; Im. 303.—Br. 7. *Nymphæa alba major* C.B.P. 193. *Nymphæa alba* L. Sp. 510 ; L.P. 230.—" In pools, meres, and lakes."

303. *Nymphæa lutea*, Geel Seebluomen, 536 ; N.K. t. cccii ; Im. 304.—Br. 6. *Nymphæa lutea major* C.B.P. 193. *Nymphæa lutea* L. Sp. 510. *Nuphar luteum* Sibth. et Sm.—" In pools, meres, and lakes."

Cap. CCIII (CCIV, N.K.) : NAPY Diosc. II, clxxxiii (clxxxiv).

304. *Sinapis primum genus*, Geeler Gartensenff, 538 ; N.K. t. ccciii ; *Sinapi hortense*, Im. 307.—Br. 249. *Sinapi apii folio sive album* C.B.P. 99. *Sinapis alba* L. Sp. 668 ; P.C. 195 ; L.P. 206.—" Commonly cultivated in gardens, and also occurs spontaneously."

305. *Sinapis alterum genus*, Weisz Gartensenff, 539 ; N.K. t. ccciv. *Eruca sylvestris*, Im. 147.—*Eruca latifolia alba* C.B.P. 98. *Brassica Eruca* L. Sp. 667. *Eruca sativa* Mill.—" Commonly cultivated in gardens, and also occurs spontaneously."

Cap. CCIV (CCV, N.K.) : NERIUM Diosc. IV, lxxxii.

306. *Nerium* (*Oleander*), Oleander, 541 ; N.K. t. cccv ; Im. 308.—*Nerion floribus rubescentibus* C.B.P. 464. *Nerium Oleander* L. Sp. 209 ; L.P. 283.—" Grows beside streams and near the sea, and is also cultivated in gardens."—The habitat " beside streams and near the sea " is copied from Dioscorides.

Cap. CCV (CCVI, N.K.) : OXYACANTHA Diosc. I, cxxii.

307. *Oxyacantha* (*Berberis*), Versich, Peisselbeer, 543 ; N.K. t. cccvi ; Im. 309.—Br. 270. *Berberis dumetorum* C.B.P. 464. *Berberis vulgaris* L. Sp. 330 ; P.C. 21 ; L.P. 120.—" Grows in many places—namely, in thickets, open country, mountains, and in both dry and wet situations."

Cap. CCVI (CCVII, N.K.) : OSYRIS Diosc. IV, cxli (cxliii).

308. *Osyris* (*Linaria*), Harnkraut, Lynkraut, 545 ; N.K. t. cccvii ; Im. 310.—Br. 109. *Linaria vulgaris lutea flore majore* C.B.P. 212. *Antirrhinum Linaria*

L. Sp. 616. *Linaria vulgaris* Mill. ; P.C. 107.—" Everywhere in uncultivated places, on walls, and behind fences."

Cap. CCVII (CCVIII, N.K.) : OCIMUM Diosc. II. clxx (clxxi).

309. *Ocimum exiguum*, Klein Basilien, 547 : N.K. t. cccviii. *Ocimum minutum*, Im. 311.—*Ocimum minimum* C.B.P. 226. *Ocimum minimum* L. Sp. 597. *Ocimum Basilicum* L., var. *minimum* Alef. Landwirthsch. Fl. 114 (1866).—" Commonly grown in pots on window-sills, sometimes also in gardens."

310. *Ocimum mediocre*, Mittel Basilien, 548 ; N.K. t. cccix : Im. 312.—*Ocimum vulgatius* C.B.P. 226. *Ocimum Basilicum* L. Sp. 597, var. *vulgare* Alef. l. c. ; P.C. 22 ; L P. 168.—Habitat as in No. 309.

311. *Ocimum magnum*, Grosz Basilien, 549 ; N.K. t. cccx *Ocimum maius*, Im. 313.—Br. 71. *Ocimum caryophyllatum majus* C.B.P. 226. *Ocimum Basilicum* L. Sp. 597, var. *majus* Alef., l. c.—Habitat as in No. 309.

Cap. CCVIII (CCIX, N.K.) : ORIGANUM Diosc. III, xxix (xxxii)–xxxii (xxxv).

312. *Origanum sylvestre seu vulgare*, Wolgemuot, 552 : N.K. t. cccxi ; Im. 315.—Br. 199 *Origanum sylvestre Cunila bubula Plinii* C.B.P. 223. *Origanum vulgare* L. Sp. 590 ; P.C. 181 ; L.P. 144.—" On mountains and steep slopes, especially in hedges."

Cap. CCIX (CCX, N.K.) : ORCHIS Diosc. III, cxxxi (cxli).

313. *Orchis mas latifolia*, Ongesprengt (Breyt) Knabenkraut mennle, 554 ; N.K. t. cccxii : Im. 316. —Br. 29. *Cynosorchis latifolia hiante cucullo major* C.B.P. 80. *Orchis militaris* L Sp. 941, *teste* Camus, Monogr. Orch. 122.—" In sandy ground, on mountains, and in meadows."

314. *Orchis mas angustifolia*, Gesprengt (Schmal) Knabenkraut mennle 555 ; N.K. t. cccxiii : Im. 317. –*Orchis morio mas foliis maculatis* C.B.P. 81. *Orchis morio*, var. *mascula* L. Sp. 941. *O. mascula* L. Sp. ed. 2, 1333 ; P.C. 244.—The lower half of the figure matches *O. mascula*, but the upper half agrees better with *O. sambucina* L.—Habitat as in No. 313.

315. *Orchis fæmina maior*, Knabenkraut weible das groesser, 556 ; N.K. t. cccxiv. *Orchis fæmina angustifolia*, Im. 318.—*Orchis pyramidalis* L. Sp. 940. *Anacamptis pyramidalis* Rich.—Habitat as in No. 313.

316. *Orchis sive cynosorchis fœmina maior*, Knabenkraut weible das kleiner, 557 ; N.K. t. cccxvi. *Orchis angustifolia fœmina altera*, Im. 319.—Habitat as in No. 313.—The figure cannot be identified with certainty. Sprengel named it *Orchis sambucina* L., but the tubers are inconsistent with that species.

Cap. CCX (CCXI, N.K.) : ORCHIS SERAPIAS Diosc. III, cxxxii (cxlii).

317. *Triorchis-serapias mas*, Knabenkraut mennle das kleiner, Ragwurtz mennle, 559 ; N.K. t. cccxvii. *Triorchis mas minor*, Im. 321.—Br. 30. *Orchis*

morio L. Sp. 940, *teste* Camus, Monogr. Orch. 103.—" Grows in rich soil and in meadows."

318. *Triorchis fœmina*, Ragwurtz weible, 560 ; N.K. t. cccxviii ; Im. 322.—*Orchis fucum referens major foliolis superioribus candidis et purpurascentibus* C.B.P. 83. *Ophrys insectifera*, var. *ι*, L. Sp. 949. *Ophrys apifera* Huds.—Habitat as in No. 317.

Cap. CCXI (CCXII, N.K.) : ŒNANTHE Diosc. III. cxxv (cxxxv).

319. *Œnanthe* (*Filipendula*), Rot Steinbrech, 562 ; N.K. t. cccxix ; Im. 323.—*Filipendula vulgaris* C.B.P. 163. *Spiræa Filipendula* L. Sp. 490. *Filipendula hexapetala* Gilib.—" In stony places and rough mountains. Abundant on the Osterberg near Tübingen."

Cap. CCXII (CCXIII, N.K.) : OXYS Plin. XXVII. xii. 89.

320. *Oxys* (*Trifolium acetosum*), Saurer Klee, Buochampffer, 564; N.K. t. cccxx ; Im. 324.—Br. 153. *Trifolium acetosum vulgare* C.B.P. 330. *Oxalis Acetosella* L. Sp. 433 ; P.C. 306.—" Common in woods, on rocks, and on roots of large trees. Also in watery places and in some hedges, as between Tübingen and the Osterberg."

Cap. CCXIII (CCXIV, N.K.) : OPHRIS (OPHRYS Plin. XXVI, xv. 93).

321. *Ophris*, Zweyblatt, 566 ; N.K. t. cccxxi ; Im. 325.—Br. 63, 65. *Ophris bifolia* C.B.P. 87. *Ophrys ovata* L. Sp. 946. *Listera ovata* R. Br.—" In humid meadows on mountains. Nowhere more abundant than on the Osterberg near Tübingen."

Cap. CCXIV (CCXV, N.K.) : ORMINUM Diosc. III, cxxxv (cxlv).

322. *Orminum sativum*, Scharlach, 568 ; N.K. t. cccxxii ; Im. 326.—*Horminum Sclarea dictum* C.B.P. 238. *Salvia Sclarea* L. Sp. 27 ; P.C. 71.—" Planted in gardens."

323. *Orminum sylvestre* (*Salvia sylvestris*), Wilder Scharlach, 569 ; N.K. t. cccxxiii ; Im. 327.—Br. 101. *Horminum pratense foliis serratis* C.B.P. 238. *Salvia pratensis* L. Sp. 25.—" In uncultivated fields and almost everywhere in meadows."

Cap. CCXV (CCXVI, N.K.) : OROBUS Diosc. II, cxxxi.

324. *Ervum sativum*, Weisz Eruen, 571 ; N.K. t. cccxxiv. *Ervum album sativum*, Im. 328.—*Lathyrus sativus flore fructuque albo* C.B.P. 343. *Lathyrus sativus*, var. *β*, L. Sp. 730.—" Cultivated in gardens ; likes meagre dry soil."

325. *Ervum sylvestre* (sphalm. " *sativum* "), Rot oder wild Eruen, 572 ; N.K. t. cccxxv ; Im. 329.—*Lathyrus sylvestris major* C.B.P. 344. *Lathyrus sylvestris* L. Sp. 733.—" In some fields and in hedges."

Cap. CCXVI (CCXVII, N.K.) : OREOSELINUM Diosc. III, lxix (lxxvi).

326. *Oreoselinum* (*Petroselinum sylvestre*), Teutsch Petersilg, Gemein Petersilg, 574 ; N.K. t. cccxxvi ; Im. 330.—Br. 181. *Apium hortense, seu Petro-*

selinum vulgo C.B.P. 153. *Apium Petroselinum* L. Sp. 264. *Petroselinum hortense* Hoffm.; P.C. 207; L.P. 43, 181. -A bad figure.—"Cultivated in Germany."

Cap. CCXVII (CCXVIII, N.K.): OE Diosc. I, clxxiii.

327. *Sorbum ovatum*, Speierling, 576; N.K. t. ccxxvii; Im. 331.—*Sorbus sativa* C.B.P. 415. *Sorbus domestica* L. Sp. 477 (*Pyrus Sorbus* Gaertn.).—"Likes humid mountainous and cold places, according to Theophrastus."

Cap. CCXVIII (CCXIX, N.K.): OPHIOGLOSSUM Fuchs.

328. *Ophioglossum*, Naterzünglin, 577; N K. t. cccxxviii; Im. 332.—*Ophioglossum vulgatum* C.B.P. 354. *Ophioglossum vulgatum* L. Sp. 1062; P.C. 3.—"In some meadows on mountains. Abundant on the Osterberg near Tübingen."

Cap. CCXIX (CCXX, N.K.): XANTHIUM Diosc. IV. cxxxvi (cxxxvii).

329. *Xanthium* (*Lappa minor*), Bettlersleusz, 579; N.K. t. cccxxix; Im. 333.—Br. 155. *Lappa minor* C.B.P. 198. *Xanthium strumarium* L. Sp. 987; L.P. 76. —Habitat "in rich ground, and in dried up lakes and marshes" taken from Dioscorides.

Cap. CCXX (CCXXI, N.K.): XYLON Plin. XIX, i. 2.

330. *Xylon* (*Gossipium*), Baumwoll, 581; N.K. t. cccxxx; Im. 334.—*Gossipium frutescens semine albo* C.B.P. 430. *Gossypium herbaceum* L. Sp. 693; P.C. 84.—"Now planted in gardens in Germany, like many other exotic plants formerly unknown to us."

Cap. CCXXI (CCXXII, N.K.): PARTHENIUM Diosc. III, cxlv (clv).

331. *Parthenium* (*Cotula fœtida*), Krottendill, 583; N.K. t. cccxxxi; Im. 335.--Br. 88. *Chamæmelum fœtidum* C.B.P. 135. *Anthemis Cotula* L. Sp. 894; P.C. 184.--"In corn, by waysides, and behind garden fences. Almost always associated with *Chamærmelum* [*Matricaria Chamomilla* L.]."

Cap. CCXXII (CCXXIII, N.K.): POLYGONATUM Diosc. IV, vi.

332. *Polygonatum latifolium*, Weiszwurtz, 585; N.K. t. cccxxxii; Im. 336.—Br. 167. *Polygonatum multiflorum* All; P.C. 264.—"On mountains and in woods."

333. *Polygonatum angustifolium*, Schmale Weiszwurtz, 586; N.K. t. cccxxxiii; Im. 337.--*Polygonatum angustifolium non ramosum* C.B.P. 303. *Convallaria verticillata* L. Sp. 315. *Polygonatum verticillatum* All.—"On mountains and in woods."

Cap. CCXXIII (CCXXIV, N.K.): POLYPODIUM Diosc. IV, clxxxv.

334. *Polypodium*, Engelfuesz, 588; N.K. t. cccxxxiv; Im. 338.—Br. 175, 184. *Polypodium vulgare* C.B.P. 359. *Polypodium vulgare* L. Sp. 1085; P.C. 224; L.P. 13.—"In woods, on mossy rocks, and on the stems and roots of trees, especially of oaks. Also found on very old pollarded willows."

Cap. CCXXIV (CCXXV, N.K.): PRASION Diosc. III, cix (cxix).

335. *Marrubium,* Weisz Andorn, 590; N.K. cccxxxv; Im. 339.—Br. 55. *Marrubium album vulgare* C.B.P. 230. *Marrubium vulgare* L. Sp. 583; P.C. 135; L.P. 128.—" On uncultivated ground, beside walls, fences, and old homesteads."

Cap. CCXXV (CCXXVI, N.K.): PERISTERION Diosc. IV, lx, lxi.
VERBENACA Plin. XV, ix. 59.

336. *Verbenaca (Verbena) recta sive mas,* Eisenkraut mennle, 592; N.K. t. cccxxxvi. *Sinapis alterum genus sylvestre,* Im. 306.—Br. 39. *Erysimum vulgare* C.B.P. 100. *Erysimum officinale* L. Sp. 660. *Sisymbrium officinale* Scop.; L.P. 199.—" In uncultivated places, by fences and ditches."

337. *Verbenaca (Verbena) supina sive fœmina,* Eisenkraut weible, 593; N.K. t. cccxxxvii; Im. 340.—Br. 37. *Verbena communis cæruleo flore* C.B.P. 269. *Verbena officinalis* L. Sp. 20; P.C. 290; L.P. 132.—" Found everywhere, in villages, behind fences, on walls, and by ditches."

Cap. CCXXVI (CCXXVII, N.K.): PTERIS Diosc. IV, clxxxiii (clxxxvi).

338. *Filix mas,* Waldfarn mennle, 595; N.K. t. cccxxxviii; Im. 341.—*Filix non ramosa dentata* C.B.P. 358. *Polypodium Filix-mas* L. Sp. 1090. *Dryopteris Filix-mas* Schott; P.C. 177; L.P. 23.—" In dark, shady, humid, sandy places, and especially in woods."

339. *Filix fœmina,* Waldfarn weible, 596; N.K. t. cccxxxix; Im. 342.—*Filix ramosa major pinnulis obtusis non dentatis* C.B.P. 357. *Pteris aquilina* L. Sp. 1075. *Pteridium aquilinum* Kuhn.—" In elevated woods and on mountains."

Cap. CCXXVII (CCXXVIII, N.K.): PEUCEDANUS Diosc. III, lxxxii (xcii).

340. *Peucedanus,* Harstrang, 599; N.K. t. cccxl; Im. 343.—*Peucedanum Germanicum* C.B.P. 149. *Peucedanum officinale* L. Sp. 245.—" On mountains. Abundant on the Spitzberg, near Tübingen."

Cap. CCXXVIII (CCXXIX, N.K.): PERSICA Diosc. I, clxiv.

341. *Persica,* Pfersichbaum, 601; N.K. t. cccxli; Im. 344.—*Persica molli carne et vulgaris, viridis et alba* C.B.P. 440. *Amygdalus Persica* L. Sp. 472. *Prunus Persica* Stokes; P.C. 209; L.P. 17.—" Everywhere in gardens, and much planted in vineyards."

Cap. CCXXIX (CCXXX, N.K.): PEPLOS Diosc. IV, clxv (clxviii).

342. *Peplos (Esula rotunda),* Teuffelsmilch, 603; N.K. t. cccxlii; Im. 345.—*Peplus sive Esula rotunda* C.B.P. 292. *Euphorbia Peplus* L. Sp. 456.—" Common in stubble fields, gardens, and vineyards."

Cap. CCXXX (CCXXXI, N.K.): PILOSELLA herbariorum *ex* Fuchs.

343. *Pilosella maior,* Nagelkraut, 605; N.K. t. cccxliii; Im. 346.—Br. 179.

Pilosella major repens hirsuta C.B.P. 262. *Hieracium Pilosella* L. Sp. 800; P.C. 192; L.P. 65.—" In poor sandy soil on hills, and on the grassy margins of fields."

344. *Pilosella minor*, Meuszoerlin, 606; N.K. t. cccxliv; Im. 347.—*Gnaphalium montanum flore rotundiore* C.B.P. 263. *Gnaphalium dioicum* L. Sp. 850. *Antennaria dioica* Gaertn. (♀ plant); P.C. 163; L.P. 193.—" On dry heaths."

Cap. CCXXXI (CCXXXII, N.K.): PIMPINELLA herbariorum et officinarum *ex* Fuchs.

345. *Pimpinella maior*, Grosz Bibinell, 608; N.K. t. cccxlv; Im. 348.—*Pimpinella saxifraga major umbella candida* C.B.P. 159. *Pimpinella saxifraga* var. *major* L. Sp. 264. *Pimpinella major* Huds. Fl. Angl. ed. 1, 110 (1762) (*P. magna* L., 1771).—" In dry meadows."

346. *Pimpinella minor*, Klein Bibinell, 609; N.K. t. cccxlvi; Im. 349.—*Angelica sylvestris* L. Sp. 251.—" On rough mountains, and in dark woods"—*vide* No. 69.

Cap. CCXXXII (CCXXXIII, N.K.): PASTORIA BURSA vulgo *ex* Fuchs.

347. *Pastoria-bursa*, Deschelkraut, Taeschelkraut, 611; N.K. t. cccxlvii; Im. 350.—Br. 145. *Bursa pastoris major folio sinuato* C.B.P. 108. *Thlaspi Bursa-pastoris* L. Sp. 647. *Capsella Bursa pastoris* Medic.; P.C. 258; L.P. 109.—" Everywhere by waysides, on walls, and in gardens."

Cap. CCXXXIII (CCXXXIV, N.K.): PES LEONIS herbariorum *ex* Fuchs.

348. *Pes-leonis* (*Alchimilla*), Synnaw, Unser Frawen Mantel, 612; N.K. t. cccxlviii; Im. 351.—Br. 116. *Alchimilla vulgaris* C.B.P. 319. *Alchemilla vulgaris*, var. *β*, L. Sp. 123; P.C. 158; L.P. 98.—" In grassy places and in some woodland meadows at high levels."

Cap. CCXXXIV (CCXXXV, N.K.): POLYGONUM MAS Diosc. IV, iv.

349. *Polygonum-mas*, Weggrasz, 614; N.K. t. cccxlix; Im. 352.—*Polygonum latifolium* C.B.P. 281. *Polygonum aviculare* L. Sp. 362; P.C. 155; L.P. 101.—" Everywhere along roads, behind fences, and in fields."

Cap. CCXXXV (CCXXXVI, N.K.): PEGANON Diosc. III, xlv (lii).

350. *Ruta-hortensis*, Weinraut, 616; N.K. t. cccl; Im. 354.—Br. 162. *Ruta hortensis latifolia* C.B.P. 336. *Ruta graveolens*, var. *γ*, L. Sp. 383; P.C. 241; L.P. 183.—" Everywhere cultivated in herb-gardens. Likes dry sunny places."

Cap. CCXXXVI (CCXXXVII, N.K.): POTENTILLA herbariorum *ex* Fuchs.

351. *Potentilla*, Genserich, 619; N.K. t. cccli; *Argemone altera vel Potentilla*, Im. 355. *Potentilla* C.B.P. 321. *Potentilla Anserina* L. Sp. 495; P.C. 259; L.P. 97.—" Everywhere by paths, damp places and streams, and in wet meadows frequented by geese."

Cap. CCXXXVII (CCXXXVIII, N.K.): PRUNELLA medicorum et herbariorum *ex* Fuchs.

352. *Prunella,* Braunellen, 621; N.K. t. ccclii; Im. 356.—*Brunella major folio non dissecto* C.B.P. 260. *Prunella vulgaris* L. Sp. 600; P.C. 255.—"Everywhere in meadows."

Cap. CCXXXVIII (CCXXXIX, N.K.): PENTAPHYLLON Diosc. IV, xlii.

353. *Quinquefolium maius candidum,* Grosz weisz Funffingerkraut, 623; N.K. t. cccliii; Im. 357.—*Quinquefolium album majus alterum* C.B.P. 325. *Potentilla alba* L. Sp. 498.—Habitat of Nos. 353–355: "In wet places and beside aqueducts" [taken from Dioscorides]. "Also in dry sandy uncultivated places, behind fences, and on walls."

354. *Quinquefolium maius luteum,* Grosz geel Funffingerkraut, 624; N.K. t. cccliv; Im. 358.—Br. 104. *Quinquefolium majus repens* C.B.P. 325. *Potentilla reptans* L. Sp. 499; P.C. 106; L.P. 97.—Habitat under No. 353.

355. *Quinquefolium minus,* Klein Funffingerkraut, 625; N.K. t. ccclv; Im. 359.—Habitat under No. 353.—An unsatisfactory figure, possibly composite. Salomon Schinz regarded it as a form of *Potentilla verna* L.

Cap. CCXXXIX (CCXL, N.K.): PISUM Plin. XVIII, vii. 10, xii. 31, 33.

356. *Pisum,* Grosz Erbsz, 627; N.K. t. ccclvi. *Pisum maius,* Im. 360. Br. 223. *Pisum hortense majus* C.B.P. 342 *Pisum sativum,* var. *β*, L. Sp. 727.—"Cultivated in gardens. Likes sunny places and cannot stand cold. Requires frequent rain."

Cap. CCXL (CCXLI, N.K.): POLYTRICHUM APULEIANUM (POLYTRICHON Apuleius Barbarus, li; ed. Humelbergius, 170).

357. *Maius Polytrichum-Apuleii,* Grosz gulden Widerthon, 629; N.K. t. ccclvii; Im. 361, dextr.—Br. 238. *Polytrichum aureum majus* C.B.P. 356. *Polytrichum commune* L. Sp. 1109.—"In mossy, permanently moist meadows in woods between mountains, sometimes also in woods at high levels on the moss of old fallen trees."

358. *Minus Polytrichum-Apuleii,* Klein gulden Widerthon, 629; N.K. t. ccclviii; Im. 361, sinistr.—*Polytrichum aureum minus* C.B.P. 356.—Mr. H. N. Dixon suggests that this may be a species of *Bryum.* Salomon Schinz identified it as *Mnium hygrometricum* L. (*Funaria hygrometrica* Sibth.).—"Found everywhere on damp rocks and walls."

Cap. CCXLI (CCXLII, N.K.): PERSICARIA herbariorum *ex* Fuchs.

359. *Persicaria,* Floehkraut, 630; N.K. t. ccclix; Im. 362.—Br. 96. *Polygonum lapathifolium* L. Sp. 360, *teste* Kirschl. Fl. Alsace, ii. 28.—"In damp places, as by meres, lakes, and bogs."

Cap. CCXLII (CCXLIII, N.K.) : PERFOLIATA omnium *ex* Fuchs.

360. *Perfoliatum* (*Perfoliata*), Durchwachsz, 632 ; N.K. t. ccclx ; Im. 363.—Br. 64. *Perfoliata vulgatissima, sive arvensis* C.B.P. 277. *Bupleurum rotundifolium* L. Sp. 236.—" Spontaneous in Wheat and Spelt fields. Also planted in gardens."

Cap. CCXLIII (CCXLIV, N.K.) : PORRUM Diosc. II, clxxviii (clxxix).

361. *Porrum capitatum*, Lauch, 634 ; N.K. t. ccclxi ; Im. 364.—Br. 188. *Porrum commune capitatum* C.B.P. 72. *Allium Porrum* L. Sp. 295.—" Cultivated in kitchen-gardens."

362. *Porrum sectivum*, Schnittlauch, 635 ; N.K. t. ccclxii ; Im. 365.—*Porrum sectivum juncifolium* C.B P. 72. *Allium Schœnoprasum* L. Sp. 301.—" Cultivated in kitchen-gardens."

Cap. CCXLIV (CCXLV, N.K.) : PULMONARIA medicorum et herbariorum *ex* Fuchs.

363. *Pulmonaria*, Lungenkraut, 637 ; N.K. t. ccclxiii ; Im. 366.—*Muscus pulmonarius* C.B.P. 361. *Lichen pulmonarius* L. Sp. 1145. *Lobaria pulmonaria* Hoffm. ; P.C. 174.—" On mossy oak and beech trees, sometimes also on mossy rocks in dark woods."

Cap. CCXLV (CCXLVI, N.K.) : PTARMICE Diosc. II, cxci (cxcii).

364. *Ptarmice* (*Pyrethrum sylvestre*), Wilder Bertram, 639 ; N.K. t. ccclxiv ; Im. 367.—Br. 262. *Dracunculus pratensis serrato folio* C.B.P. 98. *Achillea Ptarmica* L. Sp. 898.—" On high mountains and in stony places " [taken from Dioscorides]. " Also planted in gardens."

Cap. CCXLVI (CCXLVII, N.K.) : PYRETHRUM Diosc. III, lxxviii (lxxxvi).

365. *Pyrethrum*, Bertram, 641 ; N.K. t. ccclxv ; Im. 368.—*Pyrethrum flore bellidis* C.B.P. 148. *Anthemis Pyrethrum* L. Sp. 895. *Anacyclus Pyrethrum* D.C. ; P.C. 210.—" Cultivated in Germany."

Cap. CCXLVII (CCXLVIII, N.K.) : PYXOS Theophr. III, xv. 5.

366. *Buxus*, Buchszbaum, 642 ; N.K. t. ccclxvi ; Im. 369.—*Buxus arborescens* C.B.P. 471. *Buxus sempervirens* var. *arborescens* L. Sp. 983 ; L.P. 74.—" On mountains, in cold places with a sunny exposure."

Cap. CCXLVIII (CCXLIX, N.K.) : PETASITES Diosc. IV, cvi (cviii).

367. *Petasites*, Pestilenzwurtzel, 644 ; N.K. t. ccclxvii ; Im. 370.—*Petasites major et vulgaris* C.B.P. 197. *Tussilago Petasites* L. Sp. 866. *Petasites hybridus* Gaertn. Mey. et Scherb. (male plant) ; P.C. 46.—" In wet meadows, and land beside watercourses."

Cap. CCXLIX (CCL, N.K.) : PERICLYMENUS Diosc. IV, xiv.

368. *Periclymenus* (*Caprifolium*), Geyszblatt, 646 ; N.K. t. ccclxviii ; Im.

371.—*Periclymenum non perfoliatum Germanicum* C.B.P. 302. *Lonicera Periclymenum* L. Sp. 173 ; P.C. 133.—" In fields and hedges, twining on the neighbouring shrubs. Now everywhere planted in gardens."

Cap. CCL (CCLI, N.K.) : PYROS Diosc. II, cvii.

369. *Tritici primum genus*, Weyssen, 648 ; N.K. t. ccclxix ; Im. 372. *Triticum vulgare* Host.—" Cultivated almost everywhere in Germany."

370. *Tritici tertium genus*, Welscher Weyssen, 649 ; N.K. t. ccclxx ; Im. 373.—*Triticum turgidum* L. Sp. 86 ; Percival, The Wheat Plant, 241 (1921).—According to Percival, *l. c.*, the clear separation of *T. turgidum* from *T. vulgare* and *T. durum* dates from Fuchs. " Grown in Alsace, and in many fields round Tübingen."

Cap. CCLI (CCLII, N.K.) : POTAMOGETON Diosc. IV, xcix (ci).

371. *Potamogeton*, Samkraut, 651 ; N.K. t. ccclxxi ; Im. 374.—*Potamogeton rotundifolium* C.B.P. 193. *Potamogeton natans* L. Sp. 126.—" Found in still water and ditches."

Cap. CCLII (CCLIII, N.K.) : PES ANSERINUS Fuchs.

372. *Pes-anserinus*, Genszfuosz, 653 ; N.K. t. ccclxxii ; Im. 375.—*Atriplex sylvestris latifolia* C.B.P. 119. *Chenopodium rubrum* L. Sp. 218.—" Generally in kitchen-gardens, and in fields by dung-heaps."

Cap. CCLIII (CCLIV, N.K.) : PETROSELINUM Diosc. III, lxx (lxxvii).

373. *Petroselinum* (*Amomum officinarum*), Frembder Petersilien, 655 ; N.K. t. ccclxxiii. *Petroselinum Macedonicum* Im. 376.—*Sison quod Amomum officinis nostris* C.B.P. 154. *Sison Amomum* L. Sp. 252.—In order to get the plant within the limits of a page, the upper part of the stem with its dissected leaves has been omitted.—" Not spontaneous in Germany, but must be planted in gardens. The seed is used as ' Amomum ' in the druggists' shops."

Cap. CCLIV (CCLV, N.K.) : ROSA Diosc. I, cxxx.

374. *Rosa*, Rosen, 657 ; N.K. t. ccclxxiv. *Rosa hortensis et sylvestris*, Im. 377.—*Rosa rubra* C.B.P. 481. *Rosa gallica* L. Sp. ed. 2, 704 ; P.C. 239 ; L.P. 93.—A composite figure, representing both cultivated and wild roses, two flowers of *Rosa canina* L. (P.C. 94) being introduced.—" The cultivated kind is grown everywhere in gardens, the wild kind occurs in fields and hedges."

Cap. CCLV (CCLVI, N.K.) : RAPHANOS Diosc. II, cxxxvii.

375. *Raphanus sativus* (*Radix, Radicula*), Rettich, Rhettich, 659 ; N.K. t. ccclxxv ; Im. 378.—Br. 214. *Raphanus major orbicularis, vel rotundus* C.B.P. 96. *Raphanus sativus* L. Sp. 669.—" Grown in gardens. Requires rich soil."

376. *Raphanus sylvestris* (*Armoracia*) Merrettich, Meerrhettich, 660 ; N.K. t. ccclxxvi ; Im. 379.—Br. 251. *Raphanus rusticanus* C.B.P. 96. *Cochlearia Armoracia* L. Sp. 648 ; P.C. 138 ; L.P. 148 " Grown in gardens, but also

occurs sometimes spontaneously by waysides, in sandy places, and in meadows, as in the Pfaffenwiese near Tübingen, where it is abundant."

Cap. CCLVI (CCLVII, N.K.): RIBES Mauritanorum et officinarum *ex* Fuchs.

377. *Ribes*, S. Johans Beerlin, 663; N.K. t. ccclxxvii; Im. 380.—*Grossularia multiplici acino sive non spinosa hortensis rubra, sive Ribes officinarum* C.B.P. 455. *Ribes rubrum* L. Sp. 200.—"Cultivated everywhere in gardens, not only for use, but also for ornament. Used for hedges on banks in gardens and round beds."

Cap. CCLVII (CCLVIII, N.K.): RHODIA RADIX Diosc. IV, xlv.

378. *Rhodia-radix*, Rosenwurtz, 665; N.K. t. ccclxxviii. *Rosea-radix*, Im. 381.—*Radix rhodia* C.B.P. 286. *Rhodiola rosea* L. Sp. 1035. *Sedum roseum* Scop. (*S. Rhodiola* DC.).—"Grows chiefly in Austria and Hungary, but is now planted in gardens in Germany."

Cap. CCLVIII (CCLIX, N.K.): SAMPSUCHUM Diosc. I, lviii.

379. *Amaracus* (*Maiorana*), Maioran, 667; N.K. t. ccclxxix; Im. 382.—*Majorana vulgaris* C.B.P. 224. *Origanum Majorana* L. Sp. 590; P.C. 181.—"Everywhere cultivated in herb gardens, and as a pot-plant."

Cap. CCLIX (CCLXI, N.K.): SPANACHIA auct. Græc. recentior. ex Fuchs.

380. *Spanachia* (*Spinacia, Spinaceum olus*), Spinet, 669; N.K. t. ccclxxxii; Im. 383. *Lapathum hortense seu Spinacia semine spinoso* C.B.P. 114. *Spinacia oleracea* L. Sp. 1027.—"Cultivated by everybody as a pot-herb, like Mangolt."

Cap. CCLX (CCLX, N.K.): SANICULA omnium *ex* Fuchs.

381. *Sanicula fœmina*, Sanickel weible, 670; N.K. t. ccclxxxi; Im. 384.—*Helleborus niger Saniculæ folio major* C.B.P. 186. *Astrantia major* L. Sp. 235.—"On high mountains and in woods."

382. *Sanicula mas*, Sanickel mennle, 671; N.K. t. ccclxxx; Im. 385.—Br. 20. *Sanicula officinarum* C.B.P. 319. *Sanicula europœa* L. Sp. 235; P.C. 245.—"On high mountains and in woods."

Cap. CCLXI (CCLXII, N.K.): SONCHUS Diosc. II, clviii (clix).

383. *Sonchus aspera*, Genszdistel, 674; N.K. t. ccclxxxiii; Im. 386.—*Sonchus asper laciniatus et non laciniatus* C.B.P. 124. *Sonchus oleraceus* var. *asper* L. Sp. 794. *Sonchus asper* Hill.—"Everywhere in gardens and vineyards."

384. *Sonchus non-aspera*, Hasenkeel, Hasenkoel, 675; N.K. t. ccclxxxiv; Im. 387.—*Sonchus lævis laciniatus latifolius* C.B.P. 124. *Sonchus oleraceus* var. *lævis* L. Sp. 794. *Sonchus oleraceus* L. emend. Gouan.—"Everywhere in gardens and vineyards."

Cap. CCLXII (CCLXIII, N.K.) : Seris Diosc. II, clx (clxi).

385. *Intubum sativum latifolium,* Endivien, 677 ; N.K. t. ccclxxxv ; Im. 388.—*Intybus sativa latifolia sive Endivia vulgaris* C.B.P. 125. *Cichorium Endivia* L. Sp. 813, the form figured in Plenck, Ic. t. 587.—" Cultivated in gardens."

386. *Intubum sativum angustifolium,* Scariol, 677 ; N.K. t. ccclxxxvi ; Im. 389.—*Cichorium Endivia* L. Sp. 813, the form figured in Reichb. Ic. Fl. Germ. t. 1358.—" Cultivated in gardens."

387. *Intubum sylvestre* (*Intubus erraticus, Cichorea*), Wegwart, 679 ; N.K. t. ccclxxxvii ; Im. 390.—Br. 168. *Cichorium sylvestre sive officinarum* C.B.P. 125. *Cichorium Intybus* L. Sp. 813 ; P.C. 68 ; L.P. 119.—" Everywhere by waysides."

388. *Hedypnois* (*Dens leonis, Taraxacon*), Koerlkraut, 680 ; N.K. t. ccclxxxviii. *Hedypnois maior,* Im. 391.—Br. 161. *Dens Leonis latiore folio* C.B.P. 126. *Leontodon Taraxacum* L. Sp. 798. *Taraxacum officinale* Weber ; P.C. 91 ; L.P. 122.—" In gardens, and also spontaneous almost everywhere."—In N.K., Cap. cclxiii, Fuchs mentions also " Geele Wegwart," which is *Chondrilla juncea* L.

Cap. CCLXIII (CCLXIV, N.K.) : Staphylinos Diosc. III, lii (lix).

389. *Pastinaca sativa prima* (*Carota*), Zam rot Pasteney (Rot Rueben), 682 ; N.K. t. ccclxxxix ; Im. 392.—Br. 250. *Pastinaca tenuifolia sativa radice atrorubente* C.B.P. 151. *Daucus Carota,* var. γ, L. Sp. 242 (red form).—" Cultivated in gardens."

390. *Pastinaca sativa altera,* Geelrueben, Zam geel Pasteney, 683 ; N.K. t. cccxc ; Im. 393.—*Pastinaca tenuifolia sativa radice lutea* C.B.P. 151. *Daucus Carota,* var. β, L. Sp. 242 (yellow form).—" Cultivated in gardens."

391. *Pastinaca erratica,* Wilde Pasteney, 684 ; N.K. t. cccxci. *Pastinaca erratica magna,* Im. 394.—*Pastinaca tenuifolia sylvestris Dioscoridis, vel Daucus Officinarum* C.B.P. 151. *Daucus Carota* L. Sp. 242. *Daucus Carota* var. *silvestris* Alef. Landwirthsch. Fl. 161 (1866) ; P.C. 298 ; L.P. 76.—" Everywhere by waysides and in stony places and on the banks of gardens."

Cap. CCLXIV (CCLXV, N.K.) : Strychnos Diosc. IV, lxxi.

392. *Solanum hortense* (*Solanum nigrum*), Nachtschatt, 686 ; N.K. t. cccxcii ; Im. 395.—Br. 102. *Solanum Officinarum* C.B.P. 166. *Solanum nigrum* var. *vulgare* L. Sp. 186. *S. nigrum* L. emend. Mill. Gard. Dict. ed. 8, no. 1 ; L.P. 246.—" In shady places, by paths, behind fences, by walls, and on dung-hills. Also occurs in gardens."

393. *Halicacabum vulgare* (*Vesicaria, Alkakengi*), Judendocken, 687 ; N.K. t. cccxciii ; Im. 396.—Br. 237. *Solanum vesicarium, quod folliculi vesicæ inflatæ similes* C.B.P. 166. *Physalis Alkekengi* L. Sp. 183 ; P.C. 303 ; L.P.

54.—" Common in vineyards, and difficult to eradicate when once it obtains a foothold."

394. *Halicacabum peregrinum*, Welsch Schlutten, 688 ; N.K. t. cccxciv ; Im. 397.—*Pisum vesicarium fructu nigro, alba macula notato* C.B.P. 343. *Cardiospermum Halicacabum* L. Sp. 366.—" A very recently discovered species introduced from abroad into Germany. Very suitable for covering arbours."

395. *Solanum somniferum*, Dollkraut, 689 ; N.K. t. cccxcv. *Mandragora morion*, Im. 398.—Br. 268. *Solanum melanocerasos* C.B.P. 166. *Atropa Belladonna* L. Sp. 181 ; P.C. 24 ; L.P. 232.—" In stony places not far from the sea," Hist. Stirp. 689 [copied from Dioscorides]. " In woods," N.K. Cap. cclxv.

396. *Stramonia*, Rauch Oepffelkraut, 690 ; N.K. t. cccxcvi. *Nux Methel*, Im. 399.—*Solanum pomo spinoso rotundo, longo flore*, C.B.P. 168. *Datura Metel* L. Sp. 179.—" Now planted in gardens in Germany."

Cap. CCLXV (CCLXVI, N.K.) : SYMPHYTUM MAGNUM (SYMPHYTUM ALIUD Diosc. IV, x).

397. *Symphytum-magnum* (*Consolida maior*), Walwurtz, 695 ; N.K. t. cccxcvii ; Im. 400.—Br. 18, 19. *Symphytum Consolida major* C.B.P. 259. *Symphytum officinale* L. Sp. 136 ; P.C. 78 ; L.P. 102.—" In moist meadows and by streams. Also cultivated in gardens, especially the reddish-flowered kind. At Onoltzbach the flowers are usually reddish or purplish, rarely white, but at Tübingen they are all white."

Cap. CCLXVI (CCLXVII, N.K.) : SICYS Diosc. II, clxi–clxiii (clxii–clxiv).

398. *Cucumis-sativus vulgaris*, Cucumern, 697 ; N.K. t. cccxcviii ; Im. 401.—*Cucumis sativus vulgaris* C.B.P. 310. *Cucumis sativus* L. Sp. 1012.—" Commonly cultivated in Germany."

399. *Cucumis turcicus*, Turckisch Cucumer, 698 ; N.K. t. cccxcix ; Im. 402.—*Cucurbita Pepo* L. Sp. 1010, var. *oblonga* DC. in DC. Prodr. iii. 317 ; P.C. 230 ; L.P. 25.—" A recent introduction into Germany."

400. *Cucumer marinus*, Meer Cucumer, 699 ; N.K. t. cccc ; Im. 403.—*Cucurbita Pepo* L. Sp. 1010, var. *rotunda* DC. l. c. ; P.C. 230 ; L.P. 25.—" A recent introduction into Germany."

401. *Cucumer citrulus*, Citrullen, 700 ; N.K. t. ccccі ; Im. 404.—*Anguria Citrullus dicta* C.B.P. 312. *Cucurbita Citrullus* L. Sp. 1010. *Citrullus vulgaris* Schrad.—" A recent introduction into Germany."

402. *Pepo* (*Cucumis Pepo*), Pfeben, 701 ; N.K. t. ccccii ; Im. 405.—*Melo vulgaris* C.B.P. 310. *Cucumis Melo* L. Sp. 1011, var. *Cantalupo* Ser. in DC. Prodr. iii. 300.—" Grown in great quantity round Nuremberg."

Cap. CCLXVII (CCLXVIII, N.K.) : SICYS SYLVESTRIS Diosc. IV, clii (cliv).

403. *Cucumis-sylvestris* (*Cucumer asininus*), Wild Cucumer, 705 ; N.K. t. ccccii ; Im. 406.—*Cucumis sylvestris asininus dictus* C.B.P. 314. *Momordica Elaterium* L. Sp. 1010. *Ecballium Elaterium* A. Rich. ; L.P. 8.—" Cultivated in Germany. When once introduced, it seeds itself yearly."

Cap. CCLXVIII (CCLXIX, N.K.) : SMILAX HORTENSIS Diosc. II, cxxx.

404. *Smilax-hortensis* (*Phasiolus*), Welsch Bonen, 708 ; N.K. t. ccceiv ; Im. 407. *Smilax hortensis sive Phasiolus major* C.B.P. 339. *Phaseolus vulgaris* L. Sp. 723.—" Cultivated in gardens. Should be grown on stakes."

Cap. CCLXIX (CCLXX, N.K.) : SATYRION-TRIFOLIUM Diosc. III, cxxxiii (cxliii).

405. *Satyrion-trifolium*, Stendelwurtz, 710 ; N.K. t. ccccv ; Im. 408.—*Orchis trifolia major* C.B.P. 83. *Orchis bifolia* L. Sp. 939. *Habenaria bifolia* R. Br.—" In mountain meadows and sunny places."

Cap. CCLXX (CCLXXI, N.K.) : SATYRION-BASILICON auct. Græc. posterior. *ex* Fuchs.

406. *Satyrium-basilicum mas*, Kreutzbluom mennle, 712 ; N.K. t. ccccvi. *Satyrium-basilicum mas primum* Im. 409.—Br. 33. *Orchis palmata angustifolia minor* C.B.P. 85. *Orchis conopsea*, var. *β*, L. Sp. 942. *Gymnadenia conopsea* R. Br.—" On grassy mountains and in sunny places."

407. *Satyrium-basilicum fœmina*, Kreutzbluom weible, 713 ; N.K. t. ccccvii. *Satyrium-basilicum mas alterum*; Im. 410.—*Orchis maculata* L. Sp. 942 (*Orchis Fuchsii* Druce) ; P.C. 244.—" On grassy mountains and in sunny places."

Cap. CCLXXI (CCLXXII, N.K.) : SUCCISA antiqui manuscripti herbarii *ex* Fuchs.

408. *Succisa* (*Morsus diaboli*), Teuffels Abbissz, 715 ; N.K. t. ccccix ; Im. 414.—Br. 114. *Succisa glabra* C.B.P. 269. *Scabiosa Succisa* L. Sp. 98. *Succisa pratensis* Moench ; P.C. 92.—" In uncultivated mountainous places, meadows, bushy places, and felled woods."

Cap. CCLXXII (CCLXXIII, N.K.) : SCABIOSA vulgo *ex* Fuchs.

409. *Scabiosa*, Apostemkraut, 716 ; N.K. t. ccccix. *Scabiosa vulgaris*, Im. 415.—*Scabiosa pratensis hirsuta, quæ officinarum* C.B.P. 269. *Scabiosa arvensis* L. Sp. 99. *Knautia arvensis* Duby ; L.P. 73.—" In almost all meadows, especially in damp ones."

Cap. CCLXXIII (CCLXXIV, N.K.) : SMILAX ASPERA Diosc. IV, cxlii (cxliv).

410. *Smilax-aspera*, Grosz stechend Windt, 718 ; N.K. t. ccccx ; Im. 416.—*Smilax aspera fructu rubente* C.B.P. 296. *Smilax aspera* L. Sp. 1028.—" Cultivated in gardens in Germany."

Cap. CCLXXIV (CCLXXV, N.K.) : SMILAX LEVIS Diosc. IV, cxliii (clxv).

411. *Smilax-levis* (*Volubilis maior*), Grosz glatte Windt, 720 ; N.K. t. ccccxi ; Im. 417.—Br. 166 *Convolvulus major albus* C.B.P. 294. *Convolvulus sepium* L. Sp. 153. *Calystegia sepium* R. Br. ; L.P. 11.—" By fences, and in hedges and thickets."

Cap. CCLXXV (CCLXXVI, N.K.) : SISYMBRIUM Diosc. II, cliv (clv), clv (clvi).

412. *Sisymbrium* (*Mentha aquatica*), Fischmüntz, 722 ; N.K. t. ccccxii ; Im. 418.—*Mentha rotundifolia palustris, seu aquatica major* C.B.P 227. *Mentha aquatica* L. Sp. 576 ; P.C. 300. —" In pools, and on the banks of ditches."

413. *Sisymbrium cardamine* (*Nasturtium aquaticum*) Brunnenkresz, 723 ; N.K. t. ccccxiii ; Im. 419.—*Nasturtium aquaticum supinum* C.B.P. 104. *Sisymbrium Nasturtium-aquaticum* L. Sp. 657. *Nasturtium officinale* R. Br. ; L P. 149. —" In warm sources of streams."

Cap. CCLXXVI (CCLXXVII, N.K.) : SIUM Diosc. II, cliii (cliv).

414 *Sium* (*Anagallis-aquatica*), Wasserpungen, Bachpungen, 725 ; N.K. t. ccccxiv. *Sii alterum genus*, Im 421.—Br. 202, 269. *Anagallis aquatica minor folio subrotundo* C.B P. 252. *Veronica Beccabunga* L. Sp. 12 ; P.C. 38.—" In warm streams and in ditches."

Cap. CCLXXVII (CCLXXVIII, N.K.) : STRATIOTES MILLEFOLIA Diosc. IV, ci (ciii).

415. *Stratiotes-millefolia* (*Millefolium*), Garb, 727 ; N.K. t. ccccxv ; Im. 422.—Br. 204, 205. *Millefolium vulgare album* C.B.P. 140. *Achillea Millefolium* L. Sp. 899 ; P.C. 309 ; L.P. 106.—" In hard and dry situations, rough fields, and orchards, and by roads and paths."

Cap. CCLXXVIII (CCLXXIX, N K.) : SARRACENICA SOLIDAGO herbariorum *ex* Fuchs.

416. *Solidago-sarracenica*, Heydnisch Wundkraut, 728 ; N.K. t. ccccxvi ; Im. 423.—*Senecio sarracenicus* L. Sp. 871, partim. *Senecio Fuchsii* Gmel. Fl. Bad. iii. 444 (1808). —" In dark woods, and on high mountains especially in damp and dark places. Abundant on the Oedenburg near Tübingen."

Cap. CCLXXIX (CCLXXX, N.K.) : SAXIFRAGA Diosc. IV, xv.

417. *Saxifraga* (*Ruta-muraria*), Maurrauten, 730 ; N.K. t. ccccxvii. *Saxifragum, seu Empetrum*, Im. 424.—Br. 78. *Ruta muraria* C.B.P. 356. *Asplenium Ruta-muraria* L. Sp. 1081.—" In clefts and crevices of rocks and walls, especially on old churchyard walls."

Cap. CCLXXX (CCLXXI, N.K.) : SILIQUASTRUM Plin. XX, xvii. 66.

418. *Siliquastrum maius et minus*, Calechutischer Pfeffer, 732 ; N.K. t. ccccxviii. *Capsicum rubeum et nigrum*, Im. 425.—*Piper Indicum vulgatissimum*

C.B.P. 102. *Capsicum annuum* L. Sp. 188.—" A recent introduction into Germany. Cultivated in pots and in herb-gardens. Will not stand frost."

419. *Siliquastrum tertium*, Langer Indianischer Pfeffer, 733 ; N.K. t. ccccxix. *Capsicum oblongius*, Im. 426.—*Capsicum longum* DC., *teste* Dunal in DC. Prodr. xiii. sect. 1, 424.—Same remarks as No. 418.

420. *Siliquastrum quartum*, Breyter Indianischer Pfeffer, 734 ; N.K. t. cccccxx. *Capsicum latum*, Im. 427. *Capsicum cordiforme* Mill., *teste* Dunal, l. c. 427.—Same remarks as No. 418.

Cap. CCLXXXI (CCLXXXII, N.K.) : SCORODON Diosc. II, clxxxi (clxxxii).

421. *Allium hortense*, Garten Knoblauch, 736 ; N.K. t. ccccxxi ; Im. 428.—Br. 245. *Allium sativum* C.B.P. 73. *Allium sativum* L. Sp. 296 ; P.C. 113 ; L.P. 32.—" Cultivated everywhere in gardens."

422. *Allium sylvestre primum*, Wilder Knoblauch, 737 ; N.K. t. ccccxxii ; Im. 429.—*Allium sylvestre campestre purpurascens* C.B.P. 74. *Allium vineale* L. Sp. 299.—" In vineyards, arable land, and grass fields."

423. *Allium sylvestre alterum*, Feldknoblauch, 738 ; N.K. t. ccccxxiii ; Im. 430.—*Allium sylvestre bicorne flore obsoleto* C.B.P. 74. *Allium oleraceum* L. Sp. 299.—" In vineyards, arable land, and grass fields."

424. *Allium ursinum*, Waldknoblauch, 739 ; N.K. t. ccccxxiv ; Im. 431.—Br. 189. *Allium sylvestre latifolium* C.B.P. 74. *Allium ursinum* L. Sp. 300.—" In dark damp woods."

Cap. CCLXXXII (CCLXXXIII, N.K.) : SANCTI IACOBI FLOS herbariorum *ex* Fuchs.

425. *Sancti-Iacobi-herba*, S. Jacobs Bluom, 742 ; N.K. t. ccccxxv ; Im. 432.—Br. 119. *Jacobæa vulgaris laciniata* C.B.P. 131. *Senecio Jacobæa* L. Sp. 870 ; P.C. 233 ; L.P. 178.—" Everywhere on borders of fields, on banks of streams, and in sandy and hard uncultivated places."

Cap. CCLXXXIII (CCLXXXIV, N.K.) : SELINON HORTENSE Diosc. III, lxvii (lxxiv).

426. *Apium* (*Apium hortense*), Epffich, 744 ; N.K. t. ccccxxvi. *Eleoselinum sive Apium palustre* Im. 153.—Br. 174. *Apium palustre et Apium Officinarum* C.B.P. 154. *Apium graveolens* L. Sp. 264 ; P.C. 63 ; L.P. 42.—" Cultivated in gardens. Requires moist soil. Spontaneous by pools, lakes, and ditches in certain localities, as round Canstatt in Württemberg, where it is abundant."

Cap. CCLXXXIV (CCLXXXV, N.K.) : SANCTÆ BARBARÆ HERBA vulgo *ex* Fuchs.

427. *Sanctæ-Barbaræ-herba*, S. Barbara Kraut, 746 ; N.K. t. ccccxxvii. *Scopa-regia seu Sideritis latissima*, Im. 433.—*Eruca lutea latifolia, sive Barbarea* C.B.P. 98. *Erysimum Barbarea* L. Sp. 660. *Barbarea vulgaris* R. Br.—" Everywhere on grass land."

Cap. CCLXXXV (CCLXXXVI, N.K.): Saxifraga maior herbariorum et officinarum *ex* Fuchs.

428. *Saxifraga-maior seu* [*Saxifraga-*] *alba*, Weisser Steinbrech, 747; N.K. t. ccccxxviii; Im. 434.- Br. 67. *Saxifraga rotundifolia alba* C.B.P. 309. *Saxifraga granulata* L. Sp. 403.—" On dry rough stony and sandy mountains. Sometimes in mountain meadows, and in sandy orchards."

Cap. CCLXXXVI (CCLXXXVIII, N.K.): Saxifraga lutea Fuchs.

429. *Saxifraga-lutea*, Grosser Steinklee, 749; N.K. t. ccccxxx. *Lotus sylvestris*, Im. 436.—*Melilotus dentata* Pers.—This species is said by Ascherson and Graebner (Syn. Mitteleur. Fl. vi. Abt. 2, p. 443) to be absent from South Germany, but the leaves in Fuchs's picture are clearly those of it and not of *M. officinalis* Desr.—" In fields, and everywhere on the balks."

Cap. CCLXXXVII (CCLXXXIX, N.K.): Sisarum Diosc. II, cxxxix.

430. *Sisarum sativum magnum*, Grosz zam Moren, 751; N.K. t. ccccxxxi; Im 437.—*Pastinaca sativa latifolia* C.B.P. 155. *Pastinaca sativa* L. Sp. 262, var. *edulis* DC. in DC. Prodr. iv. 189. " Not spontaneous. Planted in gardens, but not yet common in Germany."

431. *Siser sativum* [*minus*], Gerlein, 752; N.K. t. ccccxxxii; *Siser sativum primum*, Im. 438.—*Sisarum Germanorum* C.B.P. 155. *Sium Sisarum* L. Sp. 251. —" Cultivated almost everywhere in kitchen-gardens."

432. *Siser sylvestre* (*Sisaron erraticum*), Wild Moren, 753; N.K. t. ccccxxxiii; Im. 439.—*Pastinaca sylvestris latifolia* C.B.P. 155. *Pastinaca sativa* L. Sp. 262, var. *sylvestris* DC. l. c.—" Everywhere in sunny meadows, by waysides, and in other uncultivated places.

Cap. CCLXXXVIII (CCXC, N.K.): Syce Diosc. I, clxxxiii.

433. *Ficus-sativa*, Feigenbaum, 755; N.K. t. ccccxxxiv; Im. 440.—*Ficus communis* C.B.P. 457. *Ficus Carica* L. Sp. 1059; P.C. 104.—" Planted already in many gardens in Germany, but very seldom matures fruit. Likes warm and sunny situations."

Cap. CCLXXXIX (CCXCI, N.K.): Spartus Diosc. IV, clv (clviii).

434. *Spartus*, Pfrimmen, 758; N.K. t. ccccxxxv; Im. 441.—*Spartium arborescens seminibus lenti similibus* C.B.P. 396. *Spartium junceum* L. Sp. 708.—" Likes dry places."—By some mistake two rotate tetramerous corollas have been inserted in the figure. These are copied in Bock (1552).

Cap. CCXC (CCXCII, N.K.): Smyrnion Diosc. III, lxxii (lxxix).

435. *Smyrnium* (*Levisticum*), Liebstoeckel, 760; N.K. t. ccccxxxvi. *Libysticum vulgare*, Im. 442.—Br. 117. *Ligusticum vulgare* C.B.P. 157. *Ligusticum Levisticum* L. Sp. 250. *Levisticum officinale* Koch; P.C. 173; L.P. 141.—" To-day grows everywhere in gardens."

Cap. CCXCI (CCXCIII, N.K.) : Silphion Diosc. III, lxxxiv (xciv).

436. *Laserpitium germanicum* (*Osteritium*), Meisterwurtz, 763 ; N.K. t. ccccxxxvii ; Im. 443.—Br. 159. *Imperatoria major* C.B.P. 156. *Imperatoria Ostruthium* L. Sp. 259 (substituted page) ; ed. 2, 371. *Peucedanum Ostruthium* Koch ; P.C. 183.—" Found on high mountains, and now cultivated almost everywhere in gardens."

Cap. CCXCII (CCXCIV, N.K.) : Stachys Diosc. III, cx (cxx).

437. *Stachys*, Riechender (Stinckende) Andorn, 766 ; N.K. t. ccccxxxviii ; Im. 444.—*Stachys major Germanica* C.B.P. 236. *Stachys germanica* L. Sp. 581.—" In rough and mountainous places [Diosc.] and on hills, associated with thistles and weeds."

Cap. CCXCIII (CCXCV, N.K.) : Secale Plin. XVIII, xvi. 40.

438. *Secale*, Rocken, 768 ; N.K. t. ccccxxxix ; Im. 445.—*Secale hybernum vel majus* C.B.P. 23. *Secale cereale* var. *hybernum* L. Sp. 84.—" Cultivated almost everywhere in Germany, especially in Riesz and Bavaria."

Cap. CCXCIV (CCXCVI, N.K.) : Sideritis prima Diosc. IV, xxxiii.

439. *Sideritis-prima*, Glidkraut, 769 ; N.K. t. ccccxl ; Im. 446.—*Sideritis vulgaris hirsuta erecta* C.B.P. 233. *Betonica annua* var. *hirsuta* L. Sp. 574. *Stachys recta* L. Mant. i. 82 (1767).—" In rough stony uncultivated places, sometimes also in meadows and orchards, especially beside fences."

Cap. CCXCV (CCXCVII, N.K.) : Sorgi Italorum *ex* Fuchs.

440. *Sorgi*, Welscher Hirsz, 771 ; N.K. t. ccccxli. *Milium Indicum Sarracenicumve, vel Sorgi*, Im. 447.—*Milium arundinaceum subrotundo semine, Sorgo nominatum* C.B.P. 26. *Holcus Sorghum* L. Sp. 1047. *Sorghum vulgare* Pers. ; P.C. 39.—" Introduced into Germany from Italy only a few years ago. Is now cultivated in many gardens, but is not easily raised."

Cap. CCXCVI (CCXCVIII, N.K.) : Serpentariæ officinarum *ex* Fuchs.

441. *Serpentaria mas seu Bistorta*, Naterwurtz mennle, 773 ; N.K. t. ccccxlii ; Im. 448.—Br. 14. *Bistorta major radice magis intorta* C.B.P. 192. *Polygonum Bistorta* L. Sp. 360 ; P.C. 28 ; L.P. 99.—" In shady humid places, especially in meadows in the Black Forest."

442. *Colubrina seu Serpentaria fœmina*, Naterwurtz weible, 774 ; N.K. t. ccccxliii ; Im. 449.—Br. 13. *Bistorta major radice minus intorta* C.B.P. 192. *Polygonum Bistorta* L.—Same habitat as No. 441.

Cap. CCXCVII (CCXCIX, N.K.) : Scordion Diosc. III, cxv (cxxv).

443. *Scordium*, Wasser Bathenig, 776 ; N.K. t. ccccxliv ; Im. 450.—*Teucrium Scordium* L. Sp. 565 ; P.C. 296 ; L.P. 126.—" Likes moist and mountainous places [Diosc.]. Little known or almost unknown only a few years ago, but now planted in many places."

Cap. CCXCVIII (CCC, N.K.) : STICHAS Diosc. III, xxviii (xxxi).

444. *Stichas* (*Stichas arabica*), Stichaskraut, 778 ; N.K. t. cccexlvi *bis* ; Im. 451.—*Stœchas purpurea* C.B.P. 216. *Lavandula Stœchas* L. Sp. 573.—" Cultivated as a pot-plant and in herb-gardens."

Cap. CCXCIX (CCCI, N.K.) : STRUTHIUM Diosc. II, cxcii (cxciii).

445. *Struthium* (*Saponaria*), Seyffenkraut, 780 ; N.K. t. cccexlvi ; Im. 452.—*Saponaria major lævis* C.B.P. 206. *Saponaria officinalis* L. Sp. 408 ; P.C. 264 ; L.P. 72.—Apparently intended for this species, but the stem is represented as covered with spreading hairs, and the inflorescence and flowers are very badly drawn.—" Now cultivated in some gardens in Germany."

Cap. CCC (CCCII, N.K.) : SCILLA Diosc. II, ccii.

446. *Scilla*, Meerzwibel, 782 ; N.K. t. cccexlvii ; Im. 453.—*Scilla vulgaris radice rubra* C.B.P. 73. *Scilla maritima* L. Sp. 308. *Urginea maritima* Baker ; P.C. 268 ; L.P. 61.—Evidently intended for *U. maritima*, which was the Meerzwiebel of the druggists. The inflorescence and the flowers are very badly drawn, two lateral inflorescences are shown instead of a single terminal one, and the flowers are represented as having a single tetramerous perianth with rounded tepals.—" Grows wherever it is planted, like onions and garlic."

Cap. CCCI (CCCIII, N.K.) : STAPHIS AGRIA Diosc. IV, cliii (clvi).

447. *Staphis-agria* (*Staphisagria*), Bismüntz, 784 ; N.K. t. cccexlviii ; Im. 454.—*Staphis agria* C.B.P. 324. *Delphinium Staphisagria* L. Sp. 531 ; P.C. 270.—" Cultivated in gardens."

Cap. CCCII (CCCVI, N.K.) : SESELI MASSILIENSE Diosc. III, liii (lx).

448. *Seseli-massiliense*, Sesel, 786 ; Vogelnest, N.K. t. cccclii. *Dauci genus tertium*, Im. 455.—*Gingidium umbella oblonga* C.B.P. 151. *Daucus Visnaga* L. Sp. 242. *Ammi Visnaga* Lam.—" Now cultivated in many gardens in Germany."

Cap. CCCIII (CCCVII, N.K.) : SANGUISORBA vulgo *ex* Fuchs.

449. *Sanguisorba maior*, Grosz Koelbleskraut, 788 ; N.K. t. ccccliii ; Im. 456.—*Pimpinella Sanguisorba major* C.B.P. 160. *Sanguisorba officinalis* L. Sp. 116 ; P.C. 45.—" Likes dry meadows and grassy places."

450. *Sanguisorba minor*, Klein Koelbleskraut, 789 ; N.K. t. cccccliv ; Im. 457.—*Pimpinella Sanguisorba minor hirsuta* C.B.P. 160. *Poterium Sanguisorba* L. Sp. 994 ; L.P. 111.—" On dry rough balks, uncultivated arable land, and sunny grass fields."

Cap. CCCIV (CCCVIII, N.K.) : SCOLYMUS Diosc. III, xiv (xvi).

451. *Scolymus* (*Cinara*, *Articocalus*), Strobildorn, 792 ; N.K. t. cccccliv ; Im. 458.—*Cinara hortensis aculeata* C.B.P. 383. *Cynara Scolymus* L. Sp. 827, var. *β*. *Cynara Scolymus* var. *aculeata* Alef. Landwirthsch. Fl. 179.—" Cultivated in gardens. Introduced into Germany a few years ago from Italy and France."

Cap. CCCV (CCCIX, N.K.): SPHATULA FŒTIDA officinarum *ex* Fuchs.

452. *Sphatula-fœtida*, Wandtleuszkraut, 794; N.K. t. cccclvi; Im. 459.—*Gladiolus fœtidus* C.B.P. 30. *Iris fœtidissima* L. Sp. 39; P.C. 117.—"Grows by fences and hedges. Common in Italy, but does not occur everywhere in Germany."

Cap. CCCVI (CCCX, N.K.): TRICHOMANES Diosc. IV, cxxxv (cxxxvii).

453. *Trichomanes* (*Polytrichon officinarum*), Widertodt, 796; N.K. t. cccclvii; Im. 460.—*Asplenium viride* Huds.—Fuchs probably included under "*Trichomanes*" both *Asplenium Trichomanes* L. and *A. viride* Huds. The figure represents the latter, which according to Martens and Kemmler, Fl. Württemberg und Hohenzollern, ed. 2, occurs on the Farrenberg, near Tübingen, a locality well known to Fuchs.—"In dark moist places and by water [from Dioscorides], but chiefly on moist and wet rocks and on old walls."

Cap. CCCVII (CCCXI, N.K.): TELIS Diosc. II, cxxiv.

454. *Fœnogrœcum* (*Fœnumgrœcum*), Bockshorn, Fenugreek, 798; N.K. t. cccclviii; Im. 461.—*Fœnumgrœcum sativum* C.B.P. 348. *Trigonella Fœnum-grœcum* L. Sp. 777; P.C. 103.—"Sown in gardens almost everywhere in Germany."

Cap. CCCVIII (CCCXII, N.K.): TELEPHIUM Diosc. II, cclvii.

455. *Telephium album*, Wundkraut weible, 800; N.K. t. cccclx. *Acetabulum-alterum album*, Im. 462.—*Sedum Telephium* var. *album* L. Sp. 430.—"In shady places, vineyards, and damp places."

456. *Telephium purpurascens*, Wundkraut mennle, 801; N.K. t. cccclix. *Acetabulum-alterum purpureum*, Im. 463.—Br. 74. *Telephium purpureum majus* C.B.P. 287. *Sedum Telephium* var. *purpureum* L. Sp. 430.—"In shady places, vineyards, and damp places."

Cap. CCCIX (CCCXIII, N.K.): TRINITATIS HERBA vulgo *ex* Fuchs.

457. *Herba-trinitatis*, Freyschamkraut, 803; N.K. t. cccclxi; Im. 464.—Br. 130. *Viola tricolor* L. Sp. 936; P.C. 127; L.P. 71. "Grown in gardens. The wild kind occurs in arable land."

Cap. CCCX (CCCXIV, N.K.): TEUTLON Diosc. II, cxlix.

458. *Beta candida*, Weisser Mangolt, 805; N.K. t. cccclxii; Im. 465.—Br. 254. *Beta alba vel pallescens, quœ Cicla officinarum* C.B.P. 118. *Beta vulgaris* var. *Cicla* L. Sp. 222.—"Planted everywhere in gardens as a pot-herb."

459. *Beta nigra*, Roter Mangolt, 806; N.K. t. cccclxiii; Im. 466.—*Beta rubra vulgaris* C.B.P. 118. *Beta vulgaris* var. *crassa* Alef. Landwirthsch. Fl. 280 (Red Mangel-wurzel).—"Planted everywhere in gardens as a pot-herb."

Cap. CCCXI (CCCXV, N.K.): TINCTORIUS FLOS Fuchs.

460. *Tinctorius-flos*, Gilbbluom, Ferbbluomen, 808; N.K. t. cccclxiv. *Flos-tinctorius*, Im. 467.—*Genista tinctoria Germanica* C.B.P. 395. *Genista tinctoria*

L. Sp. 710 ; P.C. 95.—" In dry uncultivated places and on some hills and balks of fields."

Cap. CCCXII (CCCV, N.K.) : TORDYLON Diosc. III, lvi (lxiii).

[*Vide* No. 130 (Cap. LXXXV), where the species (*Meum athamanticum*) is included in the genus *Daucus* as *D. creticus*.]

Cap. CCCXIII (CCCXVI, N.K.) : TITHYMALUS Diosc. IV, clxii (clxv).

461. *Tithymalus helioscopius*, Sonnenwendede Wolffsmilch, 811 ; N.K. t. cccclxv ; Im. 468. —Br. 235. *Tithymalus helioscopius* C.B.P. 291. *Euphorbia helioscopia* L. Sp. 459 ; L.P. 210.—" Chiefly in rubble and near towns," Hist. 810 [from Dioscorides]. " Here and there in gardens and vineyards." N.K.

462. *Tithymalus cyparissias*, Cypressene Wolffsmilch, 812 ; N.K t. cccclxvi ; Im. 469.—*Tithymalus cyparissias* C.B.P. 291. *Euphorbia cyparissias* L. Sp. 461.—" In sandy heaths and damp ground alongside streams."

463. *Tithymalus platyphyllos*, Breytbletterte Wolffsmilch, 813 ; N.K. t. cccclxvii ; Im. 470.—*Tithymalus arvensis latifolius Germanicus* C.B.P. 291. *Euphorbia platyphyllos* L. Sp. 460.—" In woods " [copied from Dioscorides].

Cap. CCCXIV (CCLXXXVII, N.K.) : TRIPHYLLON Diosc. III, cxiii (cxxiii).

464. *Trifolium-odoratum* (*Trifolium*), Sibengezeit, 815 ; N.K. t. ccccxxix. *Lotus sativa*, Im. 435.—*Lotus hortensis odora* C B P. 331. *Trifolium Melilotus-cærulea* L. Sp. 764. *Trigonella cærulea* Ser.—" Cultivated in gardens. Must be raised from seed each year."

Cap. CCCXV (CCCXVII, N.K.) : TRIFOLIUM PRATENSE Fuchs (TRIFOLIUM OFFICINARUM).

465. *Trifolium-pratense purpureum*, Braun Wisenklee, 817 , N.K. t. cccclxviii ; Im. 471.—Br. 143. *Trifolium pratense purpureum* C.B P. 327. *Trifolium pratense* L. Sp. 768 ; P.C. 235.—" Everywhere in meadows, pastures, and gardens."

466. *Trifolium-pratense album*, Weisz Wisenklee, 818 ; N.K. t cccclxix ; Im. 472.—*Trifolium montanum* L. Sp. 770.—" Everywhere in meadows, pastures, and gardens."

467. *Trifolium-pratense luteum*, Geeler Wisenklee, 819 ; N.K. t. cccclxx ; Im. 473.—Br. 124. *Trifolium pratense luteum capitulo breviore* C.B.P. 328. *Medicago lupulina* L. Sp. 779.—" Everywhere in meadows, pastures, and gardens, also among corn and in arable land."

Cap. CCCXVI (CCCXVIII, N.K.) : TRAGOPOGON Diosc. II, clxxii (clxxiii).

468. *Tragopogon*, Bocksbart, 821 ; N.K. t. cccclxxi ; Im. 474.—*Tragopogon pratense luteum majus* C.B.P. 274. *Tragopogon pratensis* L. Sp. 789.—" Everywhere in gardens and meadows."

Cap. CCCXVII (CCCXIX, N.K.): TYPHA Diosc. III, cxxiii (cxxxiii).

469. *Typha*, Narrenkolben, 823; N.K. t. cccclxxii; Im. 475.—*Typha palustris major* C.B.P. 20. *Typha latifolia* L. Sp. 971.—Cited by Linné under *T. angustifolia* L.—" In swamps and ponds."

Cap. CCCXVIII (CCCXX, N.K.): TURCICUM FRUMENTUM vulgo *ex* Fuchs.

470. *Turcicum-frumentum*, Türckisch Korn, 825; N.K. t. cccclxxiii; Im. 476.—*Frumentum Indicum Mays dictum* C.B.P. 25. *Zea Mays* L. Sp. 971; L.P. 39.—" Recently introduced into Germany from Turkey, Asia, and Greece. Now fairly common, and cultivated in many gardens."

Cap. CCCXIX (CCCXXI, N.K.): THYMUS Diosc. III, xxxviii (xliv).

471. *Thymus* (*Serpyllum Romanum*), Roemisch Quendel, Welscher Quendel, 827; N.K. t. cccclxxiv; Im. 477.—*Thymus vulgaris folio tenuiore* C.B.P. 219. *Thymus vulgaris* L. Sp. 591; P.C. 281; L.P. 146.—" Not long known in Germany. Likes poor, stony, sunny places " [" in rupestribus tenuibusque locis " Diosc.].

Cap. CCCXX (CCCXXII, N.K.): TEUCRIUM Diosc. III, ci (cxi).

472. *Teucrium*, Grosz Bathengel, 829; N.K. t. cccclxxv; Im. 478.—*Teucrium* C.B.P. 247. *Teucrium flavum* L. Sp. 565.—" Cultivated in gardens. Not long known in Germany, so far as I am aware."

Cap. CCCXXI (CCCXXIII, N.K.): HYPERICUM Diosc. III, clxi (clxxi).

473. *Hypericum* (*Perforata*), S. Johans Kraut, 831; N.K. t. cccclxxvi; Im. 479.—Br. 163. *Hypericum vulgare* C.B.P. 279. *Hypericum perforatum* L. Sp. 785; P.C. 269; L.P. 212.—" In cultivated ground, and in rough places," Hist. 830 [from Dioscorides]. " Everywhere in hedges, and on balks of arable land," N.K.

Cap. CCCXXII (CCCXXIV, N.K.): HYOSCYAMUS Diosc. IV, lxix.

474. *Hyoscyamus flavus*, Bilsam, Bilsamkraut, 833; N.K. t. cccclxxvii; Im. 480.—*Hyoscyamus niger* L. Sp. 179, var. *pallidus* (Kit.) Reichb.; P.C. 131; L.P. 239.—" Everywhere on shores, by waysides and old homesteads " [" in maritimis ruderibusque " Diosc.].

Cap. CCCXXIII (CCCXXV, N.K.): HYACINTHUS Diosc. IV, lxiv.

475. *Hyacinthus cæruleus maximus*, Blaw Mertzenbluom die groesser, 835. Grosz blaw Mertzenbluom mennle, N.K. t. cccclxxviii. *Hyacinthus cæruleus maior mas*, Im. 481.—*Hyacinthus comosus major purpureus* C.B.P. 42. *Hyacinthus comosus* L. Sp. 318. *Muscari comosum* Mill.—" In thick woods and on mountains."

476. *Hyacinthus cæruleus maior*, Blaw Mertzenbluemlin die kleiner, 836. Grosz blaw Mertzenbluom weible, N.K. t. cccclxxix. *Hyacinthus cæruleus maior fœmina*, Im. 482.—*Hyacinthus racemosus cæruleus minor latifolius* C.B.P. 43. *Hyacinthus botryoides* L. Sp. 318. *Muscari botryoides* Mill.—Same habitat

as No. 475.—In Sp. Pl. ed. 1. Linné cited the Bauhin synonym under *Hyacinthus racemosus*.

477. *Hyacinthus cæruleus mas minor*, Blaw Mertzenbluom mennle, 837. Klein blaw Mertzenbluom weible, N.K. t. cccclxxxi. *Hyacinthus cæruleus minor fœmina*, Im. 484.—Br. 66. *Scilla bifolia* L. Sp. 309 ; Gawler in Bot. Mag. t. 746, ic. dextra.—Same habitat as No. 475.

478. *Hyacinthus albicans seu fœmina*, Blaw Mertzenbluemlin weible, 838 ; Klein blaw Mertzenbluom mennle, N.K. t. cccclxxx. *Hyacinthus cæruleus minor mas*, Im. 483.—*Hyacinthus stellaris bifolius Germanicus* C.B.P. 45. *Scilla bifolia* L. Sp. 309 (white-flowered form).—Same habitat as No. 475.

Cap. CCCXXIV (CCCXXVI, N.K.) : HYSSOPUS Diosc. III, xxvii (xxx).

479. *Hyssopus hortensis*, Garten Ispen, 841 ; N.K. t. cccclxxxiii ; Im. 486.—Br. 265. *Hyssopus officinarum cærulea, sive spicata* C.B.P. 217. *Hyssopus officinalis* L. Sp. 569 ; P.C. 140 ; L.P. 198.—" Planted everywhere in gardens."

Cap. CCCXXV (CCCXXVII, N.K.) : HYDROPIPER Diosc. II, cxc (cxci).

480. *Hydropiper*, Wasserpfeffer, 843 , N.K. t. cccclxxxiv ; Im. 487.—*Persicaria urens seu Hydropiper* C.B.P. 101. *Polygonum Hydropiper* L. Sp. 361 ; P.C. 261 ; L.P. 102.—" By ponds, meres, and pools. Abundant by the river Pegnitz near Nuremberg."

[Cap. LXXXVI : DRACONTION MICRON, N.K. : DRACONTIA MICRA Diosc. II, cxcvi.]

481. *Hydropiper rubeum*, Rot Wasserpfeffer, 844. *Dracontion micron, Dracunculus minor*, Klein Schlangenkraut, N.K. t. cxxxi. *Dracunculus Plinii tertius*, Im. 132.—*Dracunculus palustris, sive radice arundinacea, Plinii* C.B.P. 195. *Calla palustris* L. Sp. 968.—" By water, and especially by the river Pegnitz not far from Nuremberg."

Cap. CCCXXVI (CCCXXVIII, N.K.) : PHLOMOS Diosc. IV, cii (civ).

482. *Verbascum candidum mas*, Weisz Wullkrautmennle, 846 ; N.K. t. cccclxxxv ; Im. 488.—Br. 156. *Verbascum Thapsus* L. Sp. 177 ; P.C. 194 ; L.P. 189.—" Grows commonly on heaths, by waysides, in hedges, and by fences, also in woods."

483. *Verbascum candidum fœmina*, Weisz Wullkraut weible, 847 ; N.K. t. cccclxxxvi ; Im. 489.—*Verbascum Lychnitis flore albo parvo* C.B.P. 240. *Verbascum Lychnitis*, var. *β*, L. Sp. 178. *Verbascum Lychnitis* L., var. *album* (Mill.) Schrad.—Same habitat as No. 482. " Abundant about Rotenburg am Neckar. Flowers snow-white, each with six little leaves."—According to Martens and Kemmler (1865, p. 388), the white-flowered variety of *V. Lychnitis* is much commoner than the yellow in Württemberg and Hohenzollern.

Penzig (1922, vol. iii, p. 93) mentions that the flowers of *V. Lychnitis* are frequently oligomerous or polymerous as regards the three outer whorls, the earliest record given by him being 1857.

484. *Verbascum nigrum*, Schwartz Wullkraut, 848 ; N.K. t. ccccLxxxvii ; Im. 490.—*Verbascum fœmina flore luteo magno* C.B.P. 239. *Verbascum phlomoides* L. Sp. ed. 2, 253.—Same habitat as No. 482.

485. *Verbascum sylvestre*, Wild Wullkraut, 849 ; N.K. t. ccccLxxxviii ; Im. 491.—*Verbascum nigrum flore ex luteo purpurascente* C.B.P. 240. *Verbascum nigrum* L. Sp. 178.—" On dry stony heaths."

486. *Verbasculum odoratum*, Geel Schlüsselbluomen, 850 ; N.K. t. ccccLxxxix ; Im. 492.—Br. 25. *Verbasculum pratense odoratum* C.B.P. 241. *Primula veris* var. *officinalis* L. Sp. 142. *Primula veris* L. emend. Huds. ; P.C. 85.—" In dry meadows and orchards."

487. *Verbasc[ul]um non-odoratum*, Weisz Schlüsselbluom, 851 ; N.K. t. ccccxc ; Im. 493.—Br. 26. *Verbasculum pratense vel sylvaticum inodorum* C.B.P. 241. *Primula veris* var. *elatior* L. Sp. 143. *Primula elatior* Schreb.—" On mountains and in woods."

Cap. CCCXXVII (CCCXXIX, N.K.) : FRAGARIA Humelbergius, Comm. Apulei Med. Herb. 139 (1537).

488 *Fragaria maior et minor*, Erdtbeer, 853 ; N.K. t. ccccxci. *Fragaria*, Im. 494. Br. 107. *Fragaria vulgaris* C.B.P. 326. *Fragaria vesca* var. *sylvestris* L. Sp. 495 (P.C. 273 ; L.P. 95) ; and *Fragaria moschata* Duchesne (*F. elatior* Ehrh.).—A composite figure representing both a wild and a cultivated strawberry.—" Spontaneous on dry grassy balks, in hedges, and especially in woods and recent clearings."

Cap. CCCXXVIII (CCCXXX, N.K.) : PHU GERMANICUM : PHU Diosc. I, x.

489. *Phu magnum* (*Valeriana maior*), Grosz Baldrion, 856 ; N.K. t. ccccxcii. *Phu verum*, Im. 495.—*Valeriana hortensis* C.B.P. 164. *Valeriana Phu* L. Sp. 32.—" Cultivated in gardens."

490. *Phu germanicum* (*Valeriana vulgaris*), Gemein Baldrion, 857 ; N.K. t. ccccxciii. *Phu vulgare*, Im. 496.—Br. 141. *Valeriana sylvestris major* C.B.P. 164. *Valeriana officinalis* L. Sp. 31, var. *latifolia* Vahl ; L.P. 164.—" In meadows, ditches, and moist stretches beside streams, where it attains a wonderful size. Occurs also in groves and woods ready for felling, but is not so luxuriant there."

Cap. CCCXXIX (CCCXXXI, N.K.) : PHACOS Diosc. II, cxxix.

491. *Lens*, Linsen, 859 ; N.K. t. ccccxciv ; Im. 497.—Br. 224. *Lens vulgaris* C.B.P. 346. *Ervum Lens* L. Sp. 738. *Lens culinaris* Medic.—" Everywhere grown as a field crop."

Cap. CCCXXX (CCCXXXII, N.K.) : PHILYRA Theophr. III, iii. 1.

492. *Tilia fœmina*, Lindenbaum, 862 ; N.K. t. ccccxcv ; Im. 498.—*Tilia fœmina folio majore* C.B.P. 426. *Tilia europæa* L. Sp. 514 (aggr.) ; P.C. 165 ;

L.P. 171.—It does not seem possible to say whether the figure represents *Tilia cordata* Mill. or *T. platyphyllos* Scop.—" Now planted everywhere."

Cap. CCCXXXI (CCCXXXIII, N.K.) : CHELIDONIUM MAIUS Diosc. II, ccxi.

493. *Chelidonium-maius* (*Chelidonia*), Schelkraut, Schoelkraut, 865 ; N.K. t. cccexcvi ; Im. 499.—Br. 82. *Chelidonium majus vulgare* C.B.P. 144. *Chelidonium majus* L. Sp. 505 ; P.C. 62 ; L.P. 208. —" Everywhere in shady places, especially by walls and old buildings, and behind fences and hedges."

Cap. CCCXXXII (CCCXXXIV, N.K.) : CHELIDONIUM MINUS Diosc. II, ccxii.

494. *Chelidonium-minus* (*Scrofularia*), Feigwartzenkraut, 867 ; N.K. t. ccccxcvii. *Malacocissus minor*, Im. 500.—Br. 75. *Chelidonia rotundifolia minor* C.B.P. 309. *Ranunculus Ficaria* L. Sp. 550 ; P.C. 216.—" On moist balks, in certain meadows, and in damp gardens."

Cap. CCCXXXIII (CCCXXXIV, N.K.) : CHAMÆDRYS Diosc. III, cii (cxii).

495. *Chamædrys vera mas*, Klein Bathengel, 869 ; N.K. t. ccccxcviii ; Im. 501.—*Chamædrys minor repens* C.B.P. 248. *Teucrium Chamædrys*, var. *β*, L. Sp. 565 ; P.C. 115 ; L.P. 126.—" On mountains under shrubs and on stony balks, as on the old Schlossberg at Rotenburg am Neckar, and on balks by the Neckar, where it is very abundant."

496. *Chamædrys vera fœmina*, Klein Bathengel weible, 870 ; N.K. t. ccccxcix ; Im. 502.—*Botrys Chamædryoides* C.B.P. 138. *Teucrium Botrys* L. Sp. 562 ; L.P. 126.—" Likes stony places."

497. *Chamædrys vulgaris mas*, Erdtweirauch, 871 ; N.K. t. ccccc ; Im. 503.—Br. 147. *Chamædrys spuria major angustifolia* C.B.P. 249. *Veronica Teucrium* L. Sp. ed. 2, 17.—" Everywhere in meadows and orchards."

498. *Chamædrys vulgaris fœmina*, Gamenderle, 872 ; N.K. t. cccccі ; Im. 504.—Br. 40. *Chamædrys spuria minor rotundifolia* C.B.P. 249. *Veronica Chamædrys* L. Sp. 13.—" Everywhere in meadows and orchards."

Cap. CCCXXXIV (CCCXXXVI, N.K.) : CHAMÆCYPARISSUS Plin. XXIV, xv. 86.

499. *Chamæcyparissus*, Cypresz, 874 ; N.K. t. cccccii ; Im. 505.—*Abrotanum fœmina foliis teretibus* C.B.P. 136. *Santolina Chamæcyparissus* L. Sp. 842 ; P.C. 161 ; L.P. 30.—" Everywhere cultivated in gardens and pots."

Cap. CCCXXXV (CCCXXXVII, N.K.) : CHAMÆCISSOS Diosc. IV, cxxiv (cxxvi).

500. *Chamæcissos* (*Hedera terrestris*), Gundelreb, Grundreb, 876 ; N.K. t. ccccciii ; Im. 506.—Br. 56. *Hedera terrestris vulgaris* C.B.P. 306. *Glechoma hederacea* L. Sp. 578 ; P.C. 122 ; L.P. 202.—" In cultivated places and by hedges and bushes. Everywhere common in gardens, and behind fences and walls. Sometimes spreads over an entire arable field."

Cap. CCCXXXVI (CCCXXXVIII, N.K.): CHRYSANTHEMUM Diosc. IV, lviii.

501. *Chrysanthemum*, Schmaltzbluom, Goldtbluom, 879; N.K. t. ccccciv. *Chrysanthemum simplex*, Im. 507.—*Ranunculus pratensis erectus dulcis* C.B.P. 179. *Ranunculus repens* L. Sp. 554, var. *suberectus* Gaud. Fl. Helvet. iii. 547.—"In damp meadows and other watery places."

Cap. CCCXXXVII (CCCXXXIX, N.K.): CHAMÆLEON ALBUS Diosc. III, viii (x).

502. *Chamæleon-albus*, Eberwurtz, 881; N.K. t. cccccv; Im. 508.—Br. 112. *Carlina caulescens magno flore* C.B.P. 380. *Carlina acaulis* L. Sp. 828; L.P. 133.—"On rough mountains, in strong white ground."—From comparison of *Cardo paris* (*panis*) Brunf. with Fuchs's figure and that given by Plenck, Ic. t. 598, I have now come to the conclusion that Sprengel was correct in identifying it as *Carlina acaulis*.—T. A. S.

Cap. CCCXXXVIII (CCCXL, N.K.): CHAMÆLEON NIGER Diosc. III, ix (xi).

503. *Chamæleon-niger*, Schwartz Gartendistel, 883; Welscher Distel, N.K. t. cccccvi. *Spina incognita*, Im. 509.—*Carduus Sphærocephalus latifolius vulgaris* C.B.P. 381. *Echinops sphærocephalus* L. Sp. 814.—"Planted in gardens. Seeds itself each year."

Cap. CCCXXXIX (CCCXLI, N.K.): CHAMÆPITYS Diosc. III, clxv, clxvi (clxxv, clxxvi).

504. *Chamæpitys prima*, Ye lenger ye lieber weible, 885; N.K. t. cccccvii; Im. 510.—*Chamæpitys incana exiguo folio* C.B.P. 249.—Impossible to identify, but probably belongs either to *Ajuga* or *Teucrium*.—"Not indigenous in Germany."

505. *Chamæpitys tertia*, Ye lenger ye lieber mennle, 886; N.K. t. cccccviii; Im. 511.—*Chamæpitys lutea vulgaris, sive folio trifido* C.B.P. 249. *Teucrium Chamæpitys* L. Sp. 562. *Ajuga Chamæpitys* Schreb.; P.C. 123.—"Likes mountainous, stony places. Grows in many places in Germany. Abundant at Rotenburg am Neckar."

Cap. CCCXL (CCCXLII, N.K.): PSYLLIUM Diosc. IV, lxx.

506. *Psyllium*, Psilienkraut, 888; N.K. t. cccccix; Im. 512.—*Psyllium majus erectum* C.B.P. 190. *Plantago Psyllium* L. Sp. 115; L.P. 16.—"Cultivated in gardens."

Cap. CCCXLI (CCCXLIII, N.K.): PSEUDONARDUS Plin. XII, xii. 26.

507. *Pseudonardus mas*, Spicanardi, 890; N.K. t. cccccx. *Pseudonardus fœmina*, Lauendel, Im. 514.—*Lavandula latifolia* C.B.P. 216. *Lavandula Spica*, var. *β*, L. Sp. 572. *Lavandula Spica* L. emend. DC., *teste* Gingins, Hist. Nat. Lavandes, 152; L.P. 166.—"Likes stony and sunny places."

508. *Pseudonardus fœmina*, Lauendel, 891; N.K. t. cccccxi. *Pseudonardus mas*, Spicanardi, Im. 513.—*Lavandula angustifolia* C.B.P. 216. *Lavandula*

Spica, var. *α*, L. Sp. 572. *Lavandula officinalis* Chaix (*L. vera* DC.), *teste* Gingins, Hist. Nat. Lavandes, 145 ; P.C. 161.—" Likes stony and sunny places."

Cap. CCCXLII (CCCXLV, N.K.) : DIGITALIS Fuchs.

509. *Digitalis purpurea*, Brauner Fingerhuot, 893 ; N.K. t. cccccxiii ; Im. 515.—*Digitalis purpurea folio aspero* C.B.P. 243. *Digitalis purpurea* L. Sp. 621 ; P.C. 108 ; L.P. 265.—" On mountains, and in shady and stony places, not common."

510. *Digitalis lutea*, Geeler Fingerhuot, 894 ; N.K. t. cccccxiv ; Im. 516.—*Digitalis ambigua* Murr., *teste* Lindl. Digital. Monogr. 13, 14, obs. 4.—" On mountains, and in shady and stony places, not common."—According to Martens and Kemmler (1865, p. 292), *D. ambigua* is found in several places near Tübingen.

Cap. CCCXLIII (CCCXLVI, N.K.) : OCIMASTRUM Diosc. Mat. Med. interpr. Marcell. Vergil. 477 (Coloniæ, 1529).

511. *Ocimastrum*, Wild Basilg, 896 ; N.K. t. ccccexv. *Acinos vel Ocimum sylvestre*, Im. 314.—*Clinopodium arvense Ocimi facie* C.B.P. 225. *Thymus Acinos* L. Sp. 591. *Satureja Acinos* Scheele.—" In sandy soil near water. Abundant near Nürtingen am Neckar."

Additional Figures in ' New Kreuterbuoch ' and ' Vivæ Imagines.'

Cap. VII, N.K. : ALSINE, Hunerdaerm.—*Vide* n. 10–12.

512. *Alsines quartum genus*, Huenerbisz, N.K., post t. xii ; Im. 13.—*Alsine hederulæ folio* C.B.P. 250. *Veronica hederifolia* L. Sp. 13.—" In all kitchen gardens and vineyards, and in woods and rich arable fields " [habitat given for all four species of *Alsine*].

Cap. XI, N.K. : ARNOGLOSSUM, Wegerich.—*Vide* n. 21, 22.

513. *Plantago minor*, Spitziger Wegerich, N.K., post t. xxii ; Im. 23.—*Plantago angustifolia major* C.B.P. 189. *Plantago lanceolata* L. Sp. 113.—" In damp places, also on balks of fields, and in gardens and meadows."

Cap. CLXXXVI, N.K. : LITHOSPERMUM, Meerhirsz.—*Vide* n. 277.

514. *Lithospermum sylvestre*, Wilder Meerhirsz, N.K. t. cclxxvi ; Im. 278.—*Lithospermum arvense radice rubra* C.B.P. 258. *Lithospermum arvense* L. Sp. 132.—" Everywhere in fields."

Cap. CCX, N.K. : ORCHIS, Knabenkraut.—*Vide* n. 313–316.

515. *Orchis fœmina media*, Knabenkraut weible das mittel, N.K. t. cccxv ; N.H. cap. CCX. *Orchis angustifolia fœmina tertia*, Im. 320.—*Orchis ustulata* L. Sp. 941.—" Grows on sandy ground, on mountains, and in meadows " [general habitat for all five species of *Orchis*].

Cap. CCCXXV, N.K. : HYACINTHUS, Mertzenbluomen.—*Vide* n. 475–478.

516. *Hyacinthus niveus*, Weisz Mertzenbluom, N.K. t. ccccIxxxii ; Im. 485.—*Hyacinthus stellaris albus* C.B.P. 46. *Scilla bifolia* L. Sp. 309 (white-flowered form).—" Grows near Nürtingen in a little wood called 'das Steinberger Hoeltzlin.' "

Cap. CCCXLIV, N.K. : ANEMONE Diosc. II, ccvii, Kuchenschell.

517. *Anemone sylvestris*, Kuchenschell, N.K. t. clxii ; Im. 1.—*Pulsatilla folio crassiore et majore flore* C.B.P. 177. *Anemone Pulsatilla* L. Sp. 539 ; P.C. 230 ; L.P. 156.—" On dry sunny mountains, also in woods."

13. *Index of accepted Scientific Names of the Plants figured.*

Acanthus mollis, 29 ; Achillea Millefolium, 415 ; A. Ptarmica, 364 ; Aconitum lycoctonum, 48 ; Adiantum Capillus-veneris, 45 ; Agrimonia Eupatoria, 137 ; Agrostemma Githago, 70 ; Ajuga Chamæpitys, 505 ; A. reptans, 221 ; Alchemilla vulgaris, 348 ; Alisma Plantago-aquatica, 23 ; Alliaria officinalis, 56 ; Allium Cepa, 243 ; A. oleraceum, 423 ; A. Porrum, 361 ; A. sativum, 421 ; A. Schœnoprasum, 362 ; A. ursinum, 424 ; A. vineale, 422 ; Aloe vera, 75 ; Althæa officinalis, 7 ; A. rosea, 288 ; Ammi majus, 38 ; A. Visnaga, 448 ; Anacamptis pyramidalis, 315 ; Anacyclus Pyrethrum, 365 ; Anagallis arvensis, 8 ; A. fœmina, 9 ; Anchusa azurea (italica), 196 ; A. officinalis, 195 ; Anemone nemorosa, 90 ; A. Pulsatilla, 517 ; A. ranunculoides, 91 ; Anethum graveolens, 16 ; Angelica sylvestris, 69, 346 ; Antennaria dioica, 344 ; Anthemis Cotula, 331 ; A. tinctoria, 14 ; Anthriscus Cerefolium, 122 ; A. sylvestris, 297 ; Apium graveolens, 426 ; Aquilegia vulgaris, 55 ; Archangelica officinalis, 68 ; Arctium Lappa, 40 ; Arenaria serpyllifolia, 12 ; Aristolochia Clematitis, 49 ; Artemisia Abrotanum, 3 ; A. Absinthium, 1 ; A. pontica, 4 ; A. vulgaris, 24 ; Arum maculatum, 39 ; Aruncus sylvester, 101 ; Asarum europæum, 5 ; Asparagus officinalis, var. altilis, 33 ; Asplenium Ruta muraria, 417 ; A. viride, 453 ; Aster Amellus, 73 ; Astrantia major, 381 ; Atriplex hortensis, 64 ; Atropa Belladonna, 395 ; Avena sativa, 103.

Ballota nigra, 84 ; Barbarea vulgaris, 427 ; Bellis perennis, 80 ; B. perennis, var. hortensis, 79 ; Berberis vulgaris, 307 ; Beta vulgaris, var. Cicla, 458 ; B. vulgaris var. crassa, 459 ; B. vulgaris, var. cruenta, 120 ; Borago officinalis, 77 ; Botrychium Lunaria, 273 ; Brassica campestris, var. Rapa, subvar. depressa, 99 ; B. campestris, var. Rapa, subvar. oblonga, 98 ; B. Napus, 236 ; B. Napus, var. napobrassica, 119 ; B. oleracea, var. acephala, subvar. sabellica, 235 ; B. oleracea, var. acephala, subvar. viridis, 234 ; B. oleracea, var. capitata, 237 ; Bryonia alba, 51 ; Bryum sp., 358 ; Bupleurum rotundifolium, 360 ; Buxus sempervirens, var. arborescens, 366.

Calendula officinalis, 216 ; Calla palustris, 481 ; Calluna vulgaris, 143 ; Calystegia sepium, 411 ; Campanula Rapunculus, 121 ; C. Trachelium, 244 ; Cannabis sativa, 222 ; Capsella Bursa-pastoris, 347 ; Capsicum annuum, 418 ; C. cordiforme, 420 ; C. longum, 419 ; Cardamine pratensis, 185 ; Cardiospermum Halicacabum, 394 ; Carlina acaulis, 502 ; C. vulgaris, 66 ; Carthamus tinctorius, 232 ; Carum Carvi, 224 ; Cassia obovata, 253 ; Castanea sativa, 214 ; Celosia cristata, 54 ; Centaurea Cyanus, 242 ; Centaurium umbellatum, 219 ; Cheiranthus Cheiri, 259 ; Chelidonium majus, 493 ; Chenopodium album, 65 ; C. Bonus-Henricus, 263 ; C. Botrys, 100 ; C. polyspermum, 97 ; C. rubrum, 372 ; Chrysanthemum Leucanthemum, 81 ; C. Parthenium, 25 ; Cicer arietinum, 150 ; Cichorium Endivia, 385, 386 ; C. Intybus, 387 ; Citrullus Colocynthis, 212 ; C. vulgaris, 401 ; Clematis Vitalba, 52 ; Cnicus benedictus, 67 ; Cochlearia Armoracia, 376 ; Colchicum autumnale, 203, 204 ; Colutea arborescens, 252 ; Conium maculatum, 230 ; Convallaria majalis, 135 ; Convolvulus arvensis, 145 ; Coriandrum sativum, 197 ; Corydalis cava, 50 ; Corylus Avellana, 225 ; C. maxima, 226 ; Crepis tectorum, 182 ;

Crocus sativus, var. officinalis, 250; Cucumis Melo, var. Cantalupo, 402; C. sativus, 398 Cucurbita Pepo, var. oblonga, 399; C. Pepo, var. rotunda, 400; Cuscuta Epilinum, 198; Cyclamen europaeum, 255; Cydonia oblonga, 213; Cynara Scolymus, 451; Cyperus longus, 256.

Daphne Mezereum, 128; Datura Metel, 396; Daucus Carota, var. silvestris, 391; D. Carota (red form), 389; D. Carota (yellow form), 390; Delphinium Consolida, 15; D. Staphisagria, 447; Dianthus carthusianorum, 200; D. Caryophyllus, 202; D. superbus, 201; Digitalis ambigua, 510; D. purpurea, 509; Diplotaxis tenuifolia, 147; Dipsacus fullonum, 126; D. sylvestris, 127; Dracunculus vulgaris, 133; Dryopteris Filix-mas, 338

Ecballium Elaterium, 403; Echinops sphaerocephalus, 503; Echium vulgare, 231, Epilobium hirsutum, 278; Equisetum arvense, var. decumbens, 184; E. palustre, 183; Erodium cicutarium, 113; Eruca sativa, 305; Eryngium campestre, 168; Eupatorium cannabinum, 149; Euphorbia cyparissias, 462; E. helioscopia, 461; E. Lathyris, 257; E. Peplus, 342; E. platyphyllos, 463; Euphrasia officinalis, 138.

Ficus Carica, 433; Filago germanica, 125; Filipendula hexapetala, 319, Foeniculum vulgare, 284; Fragaria moschata, 488; F. vesca, var. sylvestris, 488; Fumaria officinalis, 193.

Gagea lutea, 95; Galium Aparine, 28; G. Mollugo, 158; G. verum, 109; Genista germanica, 124; G. tinctoria, 460; Gentiana Cruciata, 238; G. lutea, 111; Geranium dissectum, 116; G. pratense, 117; G. Robertianum, 115; G. rotundifolium, 114; G. sanguineum, 118; Geum intermedium × urbanum, 218; G. urbanum, 217; Glaucium flavum, 295; Glechoma hederacea, 500; Glycyrrhiza glabra, 107; Gossypium herbaceum, 330; Gymnadenia conopsea, 406.

Habenaria bifolia, 405, Hedera Helix, 239, 240; Helichrysum arenarium, 53; Helleborus fœtidus, 155; H. viridis, 154; Heracleum Sphondylium, 30; Hesperis matronalis, var. hortensis, subvar. albiflora, 258, H. matronalis, var. hortensis, subvar. purpurea, 260; Hieracium Pilosella, 343; Hordeum distichon, 249; H. tetrastichum, 248; Humulus Lupulus, 92; Hyoscyamus niger, var. pallidus, 474; Hypericum hirsutum, 41; H. montanum, 42; H. perforatum, 473; Hyssopus officinalis, 479.

Impatiens Balsamina, 106; Inula Helenium, 136; Iris fœtidissima, 452; I. germanica, 180 I. Pseudacorus, 6; Isatis tinctoria, var. sativa, 188; I. tinctoria, var. vulgaris, 189.

Juglans regia, 215; Juniperus communis, 13; J. Sabina, 82.

Knautia arvensis, 409.

Lactuca sativa, 170; L. sativa, var. crispa, 169; L. Scariola, 171; Lagenaria vulgaris, var clavata, 211; L. vulgaris, var. Gourda, 210; L. vulgaris, var. turbinata, 209; Lamium album, 266; Larix decidua, 281; Laserpitium latifolium, 131; Lathyrus sativus, 324; L. sylvestris, 325; L. tuberosus, 72; Lavandula officinalis, 508; L. Spica, 507; L. Stœchas, 444; Lens culinaris, 491; Leonurus Cardiaca, 223; Lepidium campestre, 173; L. latifolium, 274; L. ruderale, 174; L. sativum, 206; Leucojum vernum, 275, 276; Levisticum officinale, 435; Ligustrum vulgare, 272; Lilium candidum, 207; L. croceum, 208; L. Martagon, 63; Linaria spuria, 94; L. vulgaris, 308; Linum usitatissimum, 267; Listera ovata, 321; Lithospermum arvense, 514; L. officinale, 277; Lobaria pulmonaria, 363; Lonicera Periclymenum, 368; Lotus corniculatus, 298; Lupinus albus, 175; Lycopsis arvensis, 151; Lysimachia Nummularia, 227; L. vulgaris, 279.

Malva Alcea, 44; M. rotundifolia, 289; M. sylvestris, 290; Mandragora officinarum, 300; Marchantia polymorpha, 268; Marrubium vulgare, 335; Matricaria Chamomilla, 13; M. inodora, 78; Matthiola incana, 177-179; Medicago lupulina, 467; Melilotus dentata, 429; Melissa officinalis, 283; Melittis Melissophyllum, 282; Mentha aquatica, 412; M. arvensis, 246; M. gentilis, 165; M. Pulegium, 110; M. rotundifolia, 163; M. sativa, 162; M. sylvestris, 166; M. viridis, 164; Mercurialis annua, 269, 270; M. perennis, 251; Meum athamanticum, 130; Momordica Balsamina, 105; Morus nigra, 296; Muscari botryoides, 476; M. comosum, 475; Myricaria germanica, 291.

Nasturtium officinale, 413; Nepeta Cataria, 245; Nerium Oleander, 306; Nigella arvensis, 287; N. damascena, 286; N. sativa, 285; Nuphar luteum, 303; Nymphæa alba, 302.

Ocimum Basilicum, var. majus, 311; O. Basilicum, var. minimum, 309; O. Basilicum, var. vulgare, 310; Ononis spinosa, 34; Onopordum Acanthium, 32; Ophioglossum vulgatum, 328; Ophrys apifera, 318; Orchis maculata, 407; O. mascula, 314; O. militaris, 313; O. Morio, 317; O. ustulata, 515; Origanum Majorana, 379; O. vulgare, 312; Oxalis Acetosella, 320.

Pæonia peregrina, 112; Panicum miliaceum, 233; Papaver Rhœas, 292, 293; P. somniferum, 294; Parietaria officinalis, 156; Paris quadrifolia, 47; Pastinaca sativa, var. edulis, 430; P. sativa, var. sylvestris, 432; Petasites hybridus, 367; Petroselinum hortense, 326; Peucedanum Cervaria, 132; P. officinale, 340; P. Ostruthium, 436; Phaseolus vulgaris, 404; Phyllitis Scolopendrium, 167; Physalis Alkekengi, 393; Pimpinella Anisum, 35; P. major, 345; Pisum sativum, 356; Plantago Coronopus, 254; P. lanceolata, 22, 513; P. major, 21; P. media, 22; P. Psyllium, 506; Polygonatum multiflorum, 332; P. verticillatum, 333; Polygonum aviculare, 349; P. Bistorta, 441, 442; P. Hydropiper, 480; P. lapathifolium, 359; Polypodium vulgare, 334; Polytrichum commune, 357; Portulaca oleracea, var. sylvestris, 62; P. oleracea, var. sativa, 61; Potamogeton natans, 371; Potentilla alba, 353; P. Anserina, 351; P. erecta, 146; P. reptans, 354; P. sp., 355; Poterium Sanguisorba, 450; Primula elatior, 487; P. veris, 486; Prunella vulgaris, 352; Prunus avium, 241; P. domestica, 228; P. Persica, 341; P. spinosa, 229; Pteridium aquilinum, 339; Pulicaria dysenterica, 247; Pyrola rotundifolia, 265.

Quercus Robur, 129.

Ranunculus acris, var. flore pleno, 87; R. arvensis, 86; R. auricomus, 85; R. bulbosus, 89; R. Ficaria, 494; R. repens, var. suberectus, 501; R. sceleratus, 88; Raphanus sativus, 375; Ribes rubrum, 377; R. Uva-crispa, 104; Ricinus communis, 194; Rorippa sylvestris, 148; Rosa canina, 374; R. gallica, 374; Rosmarinus officinalis, 271; Rubia tinctorum, 157; Rubus fruticosus, 83; Rumex Acetosa, 264; R. alpinus, 262; R. obtusifolius, 261; Ruscus Hypoglossum, 134; Ruta graveolens, 350.

Salix purpurea, 190; S. repens, var. rosmarinifolia, 192; S. vitellina, 191; Salvia officinalis, 139; S. officinalis, var. aurita, 140; S. pratensis, 323; S. Sclarea, 322; Sambucus Ebulus, 37; S. nigra, 36; Sanguisorba officinalis, 449; Sanicula europæa, 382; Santolina Chamæcyparissus, 499; Saponaria officinalis, 445; Sarothamnus scoparius, 123; Satureja Acinos, 511; S. hortensis, 172; Saxifraga granulata, 428; Scilla bifolia, 477; S. bifolia (white-flowered form), 478, 516; Scrophularia aquatica, 108; Secale cereale, var. hybernum, 438; Sedum acre, 20; S. album, 19; S. roseum, 378; S. rupestre, 18; S. Telephium, var. album, 455; S. Telephium, var. purpureum, 456; Sempervivum tectorum, 17; Senecio Fuchsii, 416; S. Jacobæa, 425; S. vulgaris, 161; Setaria italica, 142; Silybum Marianum, 31; Sinapis alba, 304; S. arvensis, 144; Sison Amomum, 373; Sisymbrium officinale, 336; S. Sophia, 2; Sium angustifolium, 152; S. Sisarum, 431; Smilax aspera, 410; Smyrnium Olusatrum, 186; Solanum Melongena, 301; S. nigrum, 392; Sonchus arvensis, 181; S. asper, 383; S. oleraceus, 384; Sorbus domestica, 327; Sorghum vulgare, 440; Spartium junceum, 434; Spinacia oleracea, 380; Stachys germanica, 437; S. officinalis, 199; S. recta, 439; Stellaria Holostea, 74; S. media, 10 Succisa pratensis, 408; Symphytum officinale, 397.

Tagetes patula, 27; Tanacetum vulgare, 26; Taraxacum officinale, 388; Teucrium Botrys, 496; T. Chamædrys, 495; T. flavum, 472; T. Scordium, 443; Thymus Serpyllum, 141; T. vulgaris, 471; Tilia europæa, 492; Tragopogon pratensis, 468; Trifolium arvense, 280; T. montanum, 466; T. pratense, 465; Trigonella cærulea, 464; T. corniculata, 299; T. Fœnum-græcum, 454; Triticum monococcum, 160; T. Spelta, 159; T. turgidum, 370; T. vulgare, 369; Tussilago Farfara, 76; Typha latifolia, 469.

Urginea maritima, 446; Urtica dioica, 58; U. pilulifera, 57; U. urens, 59.

Valeriana officinalis, var. latifolia, 490: V. Phu, 489; Veratrum album, 153; Verbascum Blattaria, 102; V. Lychnitis, var. album, 483; V. nigrum, 485; V. phlomoides, 484; V. Thapsus, 482; Verbena officinalis, 337; Veronica agrestis, 11; V. Beccabunga, 414; V. Chamædrys, 498; V. hederifolia, 512; V. officinalis, 93; V. Teucrium, 497; Vicia Faba, 220; V. sativa, 96; V. sepium, 60; Vinca minor, 205; Vincetoxicum officinale, 71; Viola odorata, 176; V. tricolor, 457; Viscum album, 187; Vitis vinifera, 46.

Xanthium strumarium, 329.

Zea Mays, 470.

14. *Index of Latin and German Names used by Fuchs in 'Vivæ Imagines,' 'New Kreüterbuoch,' and 'Den Nieuwen Herbarius' for Figures which are not in the same Sequence as in the 'Historia.'*

Acinos vel Ocimum sylvestre, 511; Alsines quartum genus, 512; Anemone sylvestris, 517.

Beerwurtz, 130.

Consolida regia, 15.

Dracontion micron, 481; Dracunculus Plinii tertius, 481.

Echium Italicum spinosum, 196; Echium lanuginosum primum, 195; Eleoselinum sive Apium palustre, 426; Equisetum brevius, 184; Eruca sylvestris, 305.

Gentianæ species, 238.

Hippuris, 183; Huenerbisz, 512; Hyacinthus niveus, 516.

Klein Schlangenkraut, 481; Knabenkraut weible das mittel, 515; Kuchenschell, 517.

Lilium purpureum, 63; Lithospermum sylvestre, 514; Lotus sativa, 464; Lycopsis, 231.

Nasturtium sylvestre, 2.

Orchis angustifolia fœmina tertia, 515; Orchis fœmina media, 515.

Plantago minor, 513; Polygonum fœmina, 183.

Schwartz Hirtzwurtz, 132; Seseli Æthiopicum, 131; Seseli Creticum, 130; Seseli Peloponnesiacum, 132; Sibengezeit, 464; Sii primum genus, 152; Sinapis primum genus sylvestre, 148; Sinapis alterum genus sylvestre, 336; Spitziger Wegerich, 513.

Tordylon, 130.

Weisz Hirtzwurtz, 131; Weisz Mertzenbluom, 516; Wilder Meerhirsz, 514.

SUMMARY OF CONTENTS.

1. *The Foundations of Modern Botany.* Revival of botany in the fifteenth century due to the Italians (p. 545).
2. *Life of Fuchs,* 1501–1566, A.D. (p. 547).
3. *Preparation and General Characteristics of the Herbal.* Prepared at Tübingen, c. 1535–1540. The localities cited are mostly from the neighbourhood of Tubingen. Characteristics of the figures. General considerations (p. 548).
4. *Objects and Arrangement of the Herbal.* Deplorable condition of pharmacy in Germany in the early sixteenth century. Attempt to remedy this by identifying and figuring the medicinal plants known to Dioscorides and Galen. Glossary of botanical terms. Four indexes—Greek, Latin, officinal, and German. Portraits of Fuchs and his draughtsmen and engraver. Chapters (genera) arranged according to the Greek alphabet. Subdivision of the chapters into six or seven sections (p. 552).

5. *Bibliographical Sources of the Herbal.* The following authors were consulted by Fuchs: Theophrastus, Dioscorides, Pliny, Galen, Oribasius, Apuleius Barbarus, Aëtius, Plinius Valerianus, Isidorus, Paulus Æginetes, Simeon Seth, Æmilius Macer, Actuarius, Ermolao Barbaro, Marcello Vergilio, Jean Ruel, Otto Brunfels, Euricius Cordus, Valerius Cordus, Hieronymus Bock (p. 554).
6. *Mediæval (or Sixteenth-century) and New Genera.* Sources of the mediæval generic names. Twelve new genera proposed by Fuchs (p. 555).
7. *Fuchs's Taxonomy.* Classification primarily pharmaceutical and economic. Reliance on philological considerations. Illustrative genera (p. 556).
8. *Fuchs's Nomenclature.* The essential nature of the nomenclature and its form do not necessarily correspond. Three generic names proposed by Fuchs, and twenty names of species, are still employed in the same sense (p. 559).
9. *The Scientific Value of the Herbal.* (1) It affords clues to the identity of mediæval plants (2) it contains the first records of over 100 plants; (3) it supplies evidence of the introduction of certain cultivated plants into Germany during the early sixteenth century; (4) many of the figures may be regarded as the "historic types" of Linnean species; (5) the figures were extensively borrowed copied or adapted in later works, which cannot be properly understood without reference to Fuchs's herbal (p. 562).
10. *Fuchs's Place in the History of Botany.* His herbal gave a picture of what was known about medicinal plants in Germany in his day, and supplied a solid basis for future research (p. 563).
11. *Systematic Conspectus of Plants figured*, with an indication in each case whether the plant was known in classical or mediæval times (p. 565).
12. *Identifications of the Figures.* To each figure is assigned a special running number, under which the Fuchsian names, principal references, and modern identification are given (p. 572).
13. *Index of accepted Scientific Names of the Plants figured* (p. 634).
14. *Index of Latin and German Names used by Fuchs in 'Vivæ Imagines,' 'New Kreüterbuoch,' and 'Den Nieuwen Herbarius' for Figures which are not in the same Sequence as in the 'Historia'* (p. 637).

The botanical identifications of the figures which form the basis of this paper, and the preparation of the pre-Linnean synonymy, are the work of the junior author. The senior author collated the Latin and German texts, summarized the habitats, and supplied the classical and other references to the names heading the chapters. He is also responsible for the Introduction (pp. 545–571).

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Some Observations on the Wound Reactions of *Ankyropteris corrugata*.

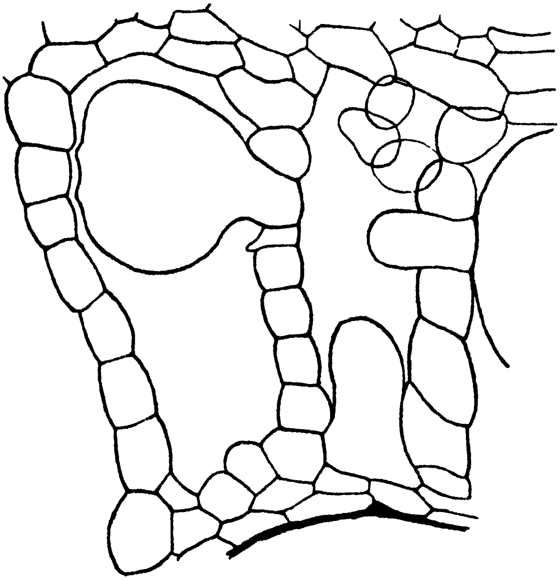
By H. S. Holden, Professor of Botany, University College, Nottingham.

(Plate 38, and 16 Text-figures.)

[Read 3rd April, 1930.]

The occurrence of petrified tissues showing well-marked wound reactions is familiar to most students of fossil plants. It seldom happens, however, that these are sufficiently numerous in any given species to enable a detailed study of them to be made. The observations recorded in the present paper were made during the course of an investigation of the general morphology of *Ankyropteris corrugata*, which involved the study of a large number of sections of this plant and which provided a favourable opportunity of recording its wound reactions.

Text-fig. 1.

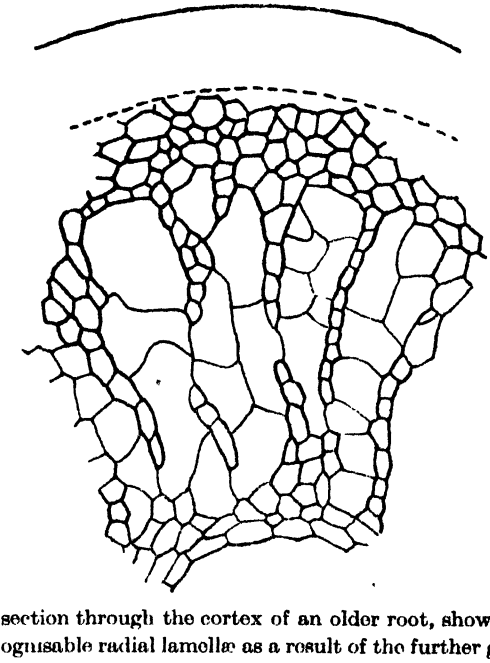


Part of a transverse section through the lacunar cortex of a young root of *Ankyropteris corrugata*, showing the development of vesiculate outgrowths from the constituent cells. × 500. Scott Coll. 2726. (Reproduced by permission of the Royal Society.)

1. *The Root.*—Although a number of roots showing injury of varying extent have been noted, in no case have the vascular tissues been involved, the wound

response being confined to the cortical cells. The normal cortex consists, in the young root, of an outer and inner zone of more or less homogeneous parenchyma, the former of which gives rise to a well-marked periderm. The two are united by radiating plates of cells which are one cell wide, except at their extremities, and which are separated by large intercellular spaces. Vesicle-like outgrowths develop from the cells constituting the plates (text-fig. 1), these first completely occluding the large intercellular spaces and subsequently, by further growth, causing a breakdown of the lamellæ (text-fig. 2). As a result, the middle cortex in older roots appears to consist of uniform rounded cells. Where wounds occur the cortical parenchyma becomes meristematic, and gives rise to groups of proliferating cells which frequently have a fan-like outline, as seen in transverse section, and which recall the condition recorded by Kidston and Lang as occurring in the stems of *Rhynia* showing internal necrosis (7). Several isolated sections of *Ankyropteris* roots showing these fan-like groups of meristem have been noted, and one such in which the affected area is indicated diagrammatically is shown in text-fig. 3. The most remarkable case, however, is one occurring in the Nottingham (Univ. Coll.) Collection in which it has been possible to trace a wounded root through a series of sections. The lowest sections in this particular example show the stele completely exposed on one side, about half the cortex being lost. The majority of the surviving cortical

TEXT-FIG. 2.

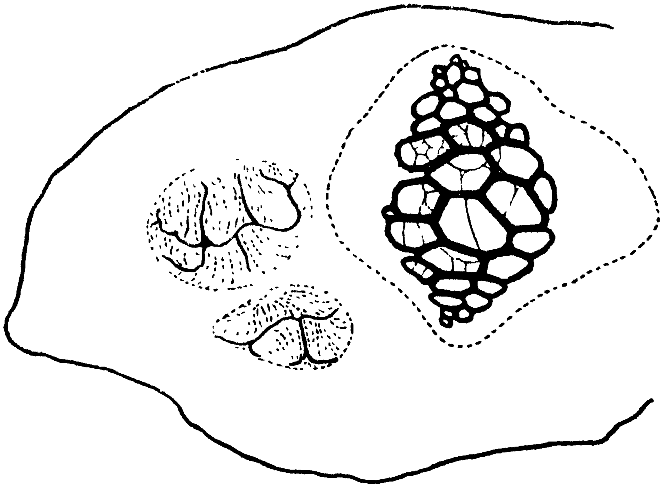


Part of a transverse section through the cortex of an older root, showing the disintegration of the still recognisable radial lamellæ as a result of the further growth of the vesicles. × 300. Scott Coll. 2726. (Reproduced by permission of the Royal Society.)

cells have undergone proliferation of the type just described, forming irregular wedges of meristem. This abnormal condition persists even when the cortex is again complete. It is figured in Pl. 38. fig. 1, from which it will be evident that the traumatic stimulus may induce vigorous reaction even at some distance from the wound itself. It may be that the condition shown in text-fig. 3 is one shown at a point remote from the actual seat of injury, and represents the last remnant of a more extensive wound reaction, though it is more probable that it is a less extensive local reaction to a slighter injury.

It is a point of some interest that the stem of *Myriophyllum*, the cortex of which has the same general structure as that of the young root of *Ankyropteris corrugata*, shows a type of wound reaction not unlike that of the fossil. In a wounded *Myriophyllum* stem the initial reaction consists in the development of vesiculate outgrowths into the intercellular spaces (text-fig. 4), which are ultimately completely occluded, the cells of the relatively compact mass of parenchyma thus produced undergoing division to form an irregular meristem (text-fig. 5). It will be noted that the development of the vesiculate outgrowths in *Myriophyllum* results only from trauma, whilst they constitute part of the normal maturation sequence in *Ankyropteris*.

TEXT-FIG. 3.



Transverse section of a wounded root. The irregular wedges of meristem are indicated by groups of dotted lines. × 300. Scott Coll. 2745.

2. *The Stem.*—The wound reactions observed in the stem are, with one possible exception, like those of the root, confined to the cortical parenchyma. In all examples I have examined the wounds consist of irregular linear fissures in the cortex, flanked on either side by strips of cambiform cells of varying width (*cf.* text-fig. 12). The exceptional case is represented by a series of sections of a bifurcating stem in the Scott Collection (nos. 2713–2720), which has already

been described in detail (**4**), and from which a typical section has been figured by Scott himself (**14**, **15**). The cortex of the stem in question shows obvious indications of injury and exhibits the type of wound reaction just described. The feature of greatest interest, however, is provided by the vascular tissues, which develop a strip of secondary xylem on either side of the stele immediately prior to its division into two. This secondary xylem consists of short, mostly reticulately thickened tracheids with a large admixture of parenchyma. The daughter steles also show the same peculiarity, one to a much greater extent than the other. In its character and in its relation to the branching of the axis the secondary xylem shows a distinct similarity to that described by Lang as occurring in injured stems of *Helminthostachys zeylanica* (**9**). It should be noted, however, that bifurcation of the axis is a normal characteristic of the fossil species, and that, apart from the case under discussion, this bifurcation has not been found to be accompanied by the development of secondary xylem. In *Helminthostachys* the uninjured axis is unbranched, except for the vestigial axillary buds, and both branch development and accessory xylem are due to traumatic stimulus. It is suggested that in the fossil plant the formation of the secondary tissues has resulted from the combination of traumatic stimulus and bifurcation.

TEXT-FIGS. 4 & 5.

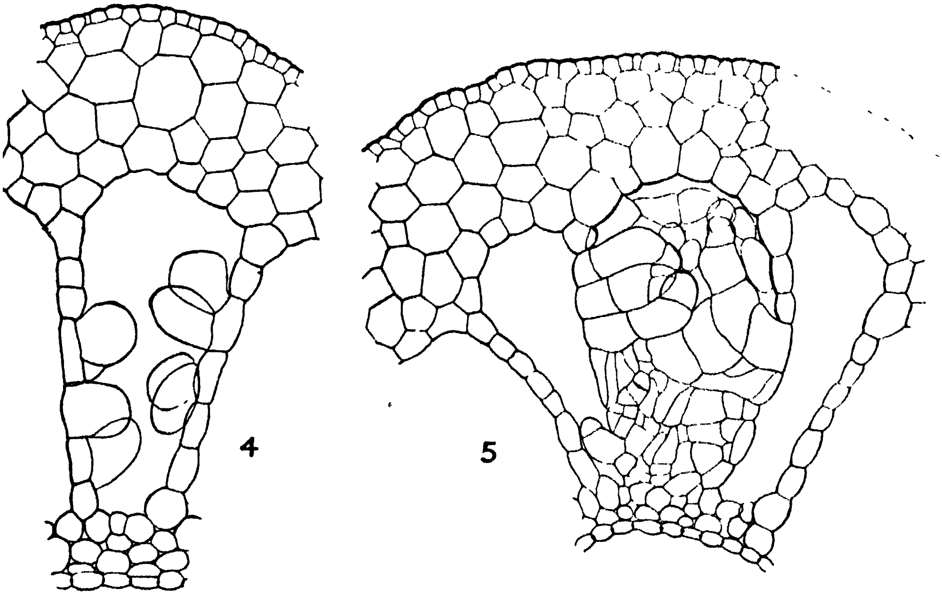


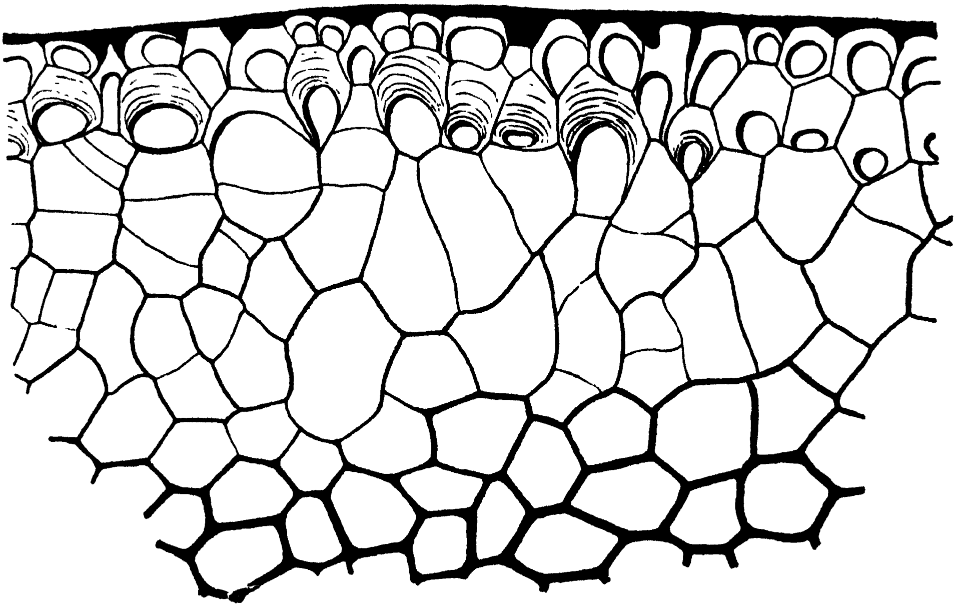
Fig. 4.—Transverse section of part of the cortex of an injured stem of *Myriophyllum*, showing the development of vesiculate outgrowths from the cells of the lacunar middle cortex. × 300.

Fig. 5.—A later stage, showing the complete occlusion of the lacuna and the subdivision of the occluding cells. × 300.

3. *The Petiole.*—Specimens of the petiole showing wound reactions are more numerous, and the type of wound reaction is more varied than in either the root or stem. The centre of the uninjured petiole is occupied by an undivided xylem trace, consisting of a median bar showing a slight abaxial curvature, from either end of which an abaxial and an adaxial lateral piece or antenna arise. These are linked by a chain of smaller tracheids termed the peripheral loop or filament. The phloem follows the contours of the xylem.

The cortex consists of an inner zone of thin-walled rounded cells and an outer zone of sclerised cells, as in most existing ferns. At and near the base of the petiole the sclerenchyma is surrounded by a further thin sheath of parenchyma, which gives rise to a slight periderm. The epidermal and subepidermal cells have strongly thickened stratified walls, the bulk of the thickening being confined to the outer and radial walls (text-fig. 6). Above the basal region of the petiole the outer parenchyma dwindles in amount, so that the sclerenchyma is generally in direct contact with the epidermis.

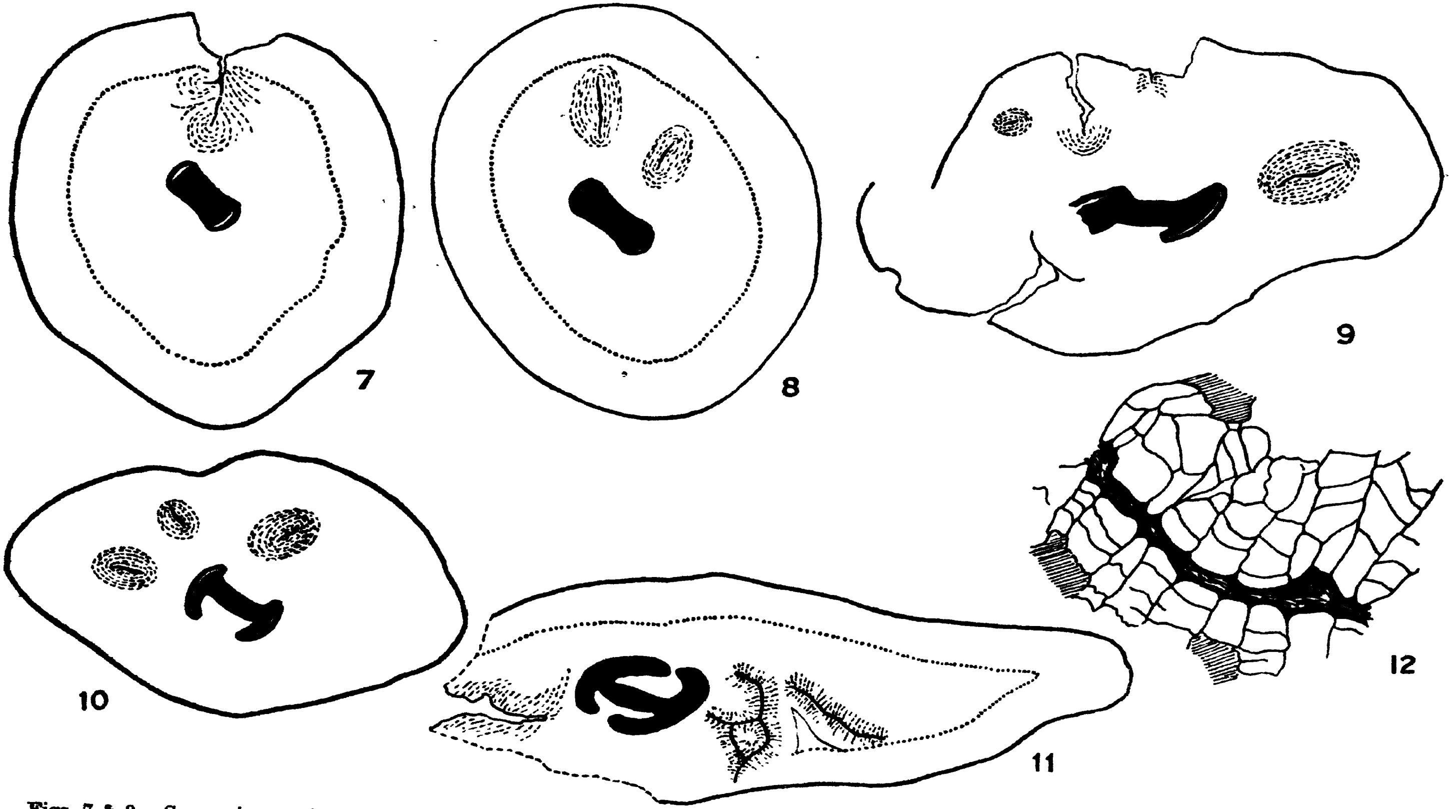
TEXT-FIG. 6.



Part of a transverse section of a petiole of *Ankyropteris corrugata* a little way above the base, showing the lamellar thickening of the outer cells and occasional divisions of the subjacent parenchyma. × 600. Univ. Coll. (London) Coll. K 602. (Reproduced by permission of the Royal Society.)

We may divide the injured petioles into two categories :—(*a*) those in which the wound reaction is confined to the cortical tissues, and (*b*) those in which the vascular tissues are also involved. The first of these again includes wounds

TEXT-FIGS. 7–12.

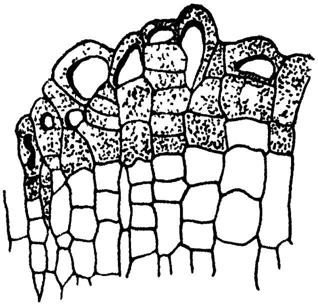


Figs. 7 & 8.—Successive sections through a " crush " wound in the petiole of *A. corrugata*: the meristematic zone is indicated by groups of dotted lines. Both ×20. Fig. 7, Scott Coll. 2680. Fig 8, Scott Coll. 2679.
Figs. 9 & 10.—Similar sections through another petiole of *A. corrugata*. Both ×20. Fig. 9, Scott Coll. 2745. Fig. 10, Scott Coll. 2744.
Fig. 11.—Similar section through a petiole of *A. westphaliensis*. ×20. Scott Coll. 2745.
Fig. 12.—Portion of wound fissure from text-fig. 11. ×600.

of two types, namely, relatively superficial ones produced by the removal of the epidermis and subjacent cortex locally, and others which may, provisionally, be termed " crush " wounds. This second type is frequently characterised by one or more rather ragged breaks in the surface-tissues, these connecting with irregular cortical fissures which may persist for a considerable vertical interval before dying out. Similar fissures, quite independent of the others, may also occur at the same levels (text-figs. 7–12). I have termed these " crush " wounds, because it is possible to produce similar effects in the tissues of living plants by local compression, although it is possible that, in the fossil, they may have been due to other causes.

The superficial wounds result in the development of a well-marked meristem consisting of regular rows of cambiform cells produced by the subdivision of the cortical parenchyma. An example of this kind is shown in Pl. **38**. fig. 2, and it is a point of some interest that, in this particular section, not only have the parenchymatous cortical cells divided but some of the thick-walled cells of the outer cortex have also undergone one or two divisions, thus showing that, as in existing ferns, they were living units.

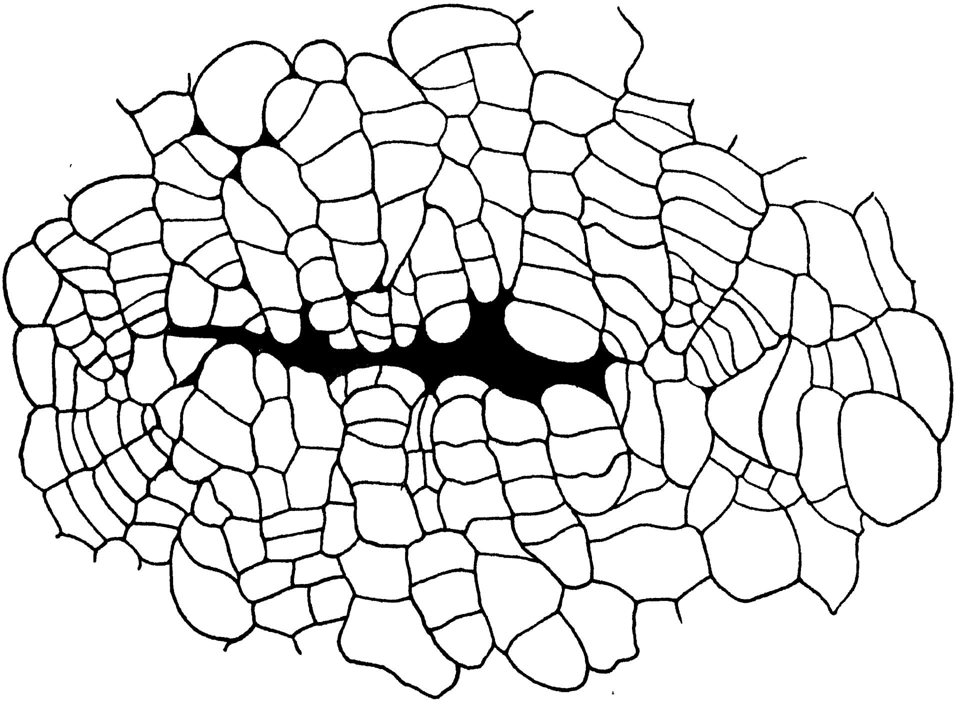
TEXT-FIG. 13.



Small portion of the wound meristem from the petiolar cortex of *A. corrugata*. The cells of the outer strip have dark contents and the superficial cells are thickened in a manner similar to those shown in text-fig. 6. ×400. Kidston Coll. 2033.

A petiole in the Kidston Collection (slide no. 2033), in which a wound of this type is present, shows two further features which are distinctive enough to be worthy of mention. The first of these is the division of the somewhat broad strip of cambiform tissue into distinct inner and outer zones, the latter of which is distinguished by the dark brown contents of its cells (Pl. **38**. fig. 3). It is evident that this colour is due to some secretory product, though whether this consisted of gum such as so frequently occurs in similar cases in existing ferns there is no means of knowing. The second feature to which reference may be made is the modification of the surface-cells, the majority of which have developed thick stratified outer and radial walls similar to those of the intact epidermis and which suggest an attempt to restore the continuity of that tissue (text-fig. 13). Traces of this type of superficial specialisation also occur in some of the wounded petioles in the Scott Collection (*e. g.*, slide no. 2745). In the "crush" wounds the cortical fissures which are characteristic of this type of injury are flanked on either side by the usual cambiform elements for a width of from four to eight cells (*cf.* text-fig. 13). Where the fissures are isolated the meristematic cells form a surrounding sheath which is ovoid in transverse section (text-fig. 14).

TEXT-FIG. 14.



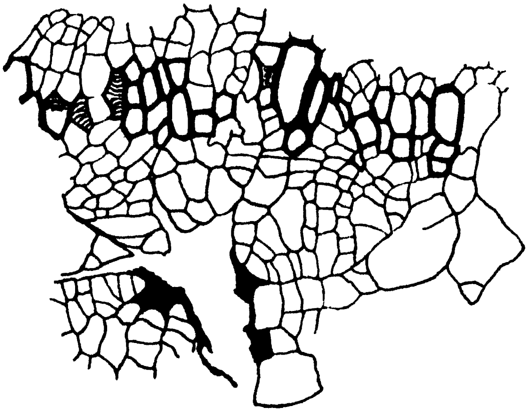
Cortical wound fissure surrounded by a sheath of meristem, *A. corrugata.* × 600.
Scott Coll. 2711.

It may be noted in passing that wounds of this type also occur in the related *Ankyropteris westphaliensis*, and an example from the Scott Collection is shown diagrammatically in text-fig. 11.

A case differing somewhat from any of the ones decribed above is shown by a petiole, half of which appears to have been lost in the region from which the section has been cut. The plane of the wound lies about the middle of the central bar and is at right angles to it, so that the transverse section is semicircular (Pl. 38. fig. 4). The superficial cells have collapsed forming a protective scab, and the intact parenchymatous cells underlying these have elongated towards the injured region, and, sometimes at least, have divided, though they have not produced a well-defined meristem like that shown by many other specimens.

The petioles in which the vascular elements are modified as a result of trauma show evidence of deep-seated wounds. In the cortical regions of such petioles the characteristic cambiform subdivision of the parenchyma is usually well marked, but they have also developed secondary xylem and, in one at least, there is some evidence that a strip of secondary phloem has been produced. Many of the secondary tracheids are short, and the pitting is frequently reticulate rather than scalariform. Their distribution varies to some extent with the

TEXT-FIG. 15.



TEXT-FIG. 16.

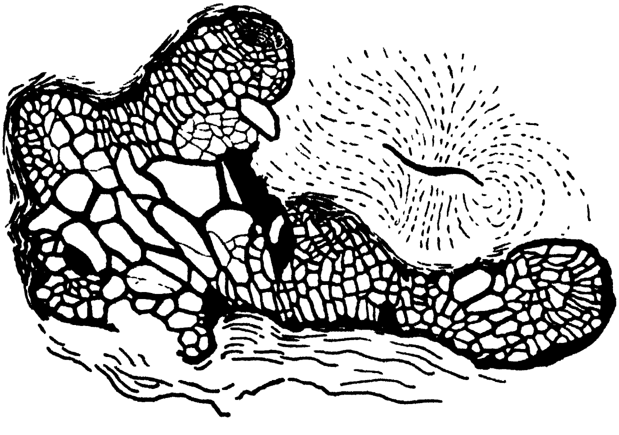


Fig. 15.—Central bar of a wounded petiole of *A. corrugata* consisting largely of short secondary tracheids and parenchyma. × 300. Scott Coll. 2744.

Fig. 16.—Stele of a badly wounded petiole of *A. corrugata*, showing large development of secondary tracheids. The meristematic tissues in the inner cortex are indicated by groups of dotted lines. × 300. Scott Coll. 2684.

position of the wound, the simplest example being that shown in Pl. **38**. fig. 5, in which they occur in two strips, one on either side of the central bar. In other cases (*e. g.*, Scott Coll. no. 2744) the central bar itself appears to have been injured whilst still immature, and to have been replaced, in part at least, by small secondary tracheids mixed with parenchyma (text-fig. 15).

In two other petioles which have come under my observation the development of secondary vascular elements is more extensive. One of these (Scott Coll. no. 2684) has undergone severe injury, which has involved the whole of the central bar and has resulted in the loss of one pair of antennæ, whilst the other pair is profoundly modified. As will be seen from text-fig. 16 the central bar consists almost entirely of secondary tracheids, whilst a further strip of similar character constitutes the bulk of the more prominent surviving antenna. The small group of thin-walled meristematic cells lying immediately inside this antenna is probably either phloem or phloem-parenchyma, although the position of the tissues is so distorted that it is impossible to be certain of this.

A section of the second petiole, which is in the Nottingham Collection, is shown in Pl. **38**. fig. 6. It will be seen from this that a strip of irregular parenchyma is situated in the position normally occupied by the central bar. To the left of this is a narrow strip of small secondary tracheids, whilst on the opposite side is a strip of what I think is either secondary phloem or phloem-parenchyma. The most extensive group of secondary tracheids, however, is about ten cells in depth at its widest part, and is one which is developed asymmetrically in contact with the peripheral loop, which is uppermost in the figure. These are all of relatively small calibre, resembling in this respect the primary tracheids to which they are attached. From the examples described above it will be seen that secondary tracheids may be developed (*a*) to augment the primary xylem elements of the central bar, the antennæ, or the peripheral loop, or (*b*) partly or completely to replace the primary tracheids in one or other of the constituent parts of the leaf-trace, whilst the parenchymatous tissues constituting the phloem may also become meristematic—although the evidence here is less convincing.

DISCUSSION.

Investigation of the healing of wounds in the tissues of existing ferns has shown that this is often accomplished by the development of a well-defined meristem, especially where the injury occurs in immature actively growing tissues (**3**). Where, on the other hand, older tissues are involved, the wound response takes the form of a local thickening of the cortical cells usually accompanied by some degree of lignification (**3**). Similar wound reactions also occur in the aerial stem of *Psilotum triquetrum* (**5**).

Priestley considers that in ferns the variations in wound response are to be correlated with the development of a suberin lamella in the endodermal cells, meristematic activity only being evinced whilst the endodermis is in the primary condition and, therefore, offering a less effective barrier to the diffusion of soluble substances from the stele (**12**, **13**). This explanation does not, however, account for the similar variation occurring in *Psilotum*, in which the primary condition of the endodermis is permanent, and the whole question needs critical re-investigation. The formation of a healing meristem in cortical tissues following wounding is very general in phanerograms, so that *Ankyropteris corrugata* reacts similarly to both these and to other pteridophytes which have been investigated.

The specimen in which the superficial cells of the wound meristem have become modified so as to resemble normal epidermal cells appears to be unique, and is a clear case of " restitution " as defined by Küster (**8**). Such restitution is rare even in phanerogams, though Massart (**11**) has recorded the regeneration of the trichome-bearing epidermis of *Lysimachia vulgaris* after removal, and Lopriore (**10**) has shown that the piliferous layer of the root in monocotyledons may be similarly renewed.

The examples in which wounding has been followed by the development of secondary tracheids may be discussed somewhat more fully. Secondary thickening is extremely rare in ferns. Among fossil forms, however, it is characteristic of the axis and the base of the petiole in *Botrychioloxylon paradoxum* (**15**) and is also frequent in the roots of *Ankyropteris corrugata*, though normally absent from the stem and petiole (**4**), whilst it also occurs in rare instances in *Metaclepsydropsis duplex* (**2**). Secondary thickening is also a normal feature of the stem in certain species of *Botrychium* (e. g., *B. virginianum*) (**1**). Traumatic secondary xylem is equally rare and that described by Lang in *Helminthostachys* (**9**), where it is intimately related to the development of the normally abortive axillary buds following injury to the parent axis, is the only case where it has been fully investigated. I have, however, noted the development of some secondary tracheids in the roots of the Marattiaceæ following injury, and these I hope to describe fully in a later paper.

Their occurrence in the petioles of *Ankyropteris corrugata* is, so far as I am able to ascertain, without parallel, and raises the question as to how much reliance is to be placed on vascular changes induced by trauma as indications of earlier evolutionary stages of vascular organisation. They can hardly be interpreted as a " recalled " ancestral condition, since, apart from the somewhat peculiar instance of *Botrychioxylon paradoxum* to which reference has already been made, they are unknown elsewhere in the Filicales. They would, one supposes, be regarded by Prof. Jeffrey and his school (**6**) as an example of accelerated evolution following wounding. Even if we accept this interpretation, we are faced with the difficulty that in this species the root, supposedly a conservative organ as regards vascular structures, normally develops secondary xylem. It seems obvious that vascular modifications resulting from wounding do not necessarily provide data upon which valid conclusions as to ancestral vascular organisation can be founded.

SUMMARY.

1. The tissues of the fossil fern *Ankyropteris corrugata* show well-marked reactions to wounding.

2. In the root these, which consist of irregularly disposed wedges of meristematic tissue, are confined to the cortical parenchyma and may extend for some distance beyond the actual wound area.

3. In the stem the wounds generally take the form of irregular cortical fissures. These are bordered on either side by a strip of meristem four to eight cells in depth.

4. Anomalous secondary xylem which occurs in a stem in the neighbourhood of a bifurcation is also considered to be due probably to traumatic stimulus.

5. In the petiole the wound reaction varies.

6. Where the wound is superficial a pad of healing meristem is developed from the cortical cells. The parenchymatous cells are most active, but the sclerenchymatous cells may also undergo division. Exceptionally the superficial cells may be modified in a similar way to those of the normal epidermis, thus providing an example of "restitution."

7. Other wounds, termed "crush" wounds, are characterised by irregular cortical fissures. These become bordered or surrounded by a strip of meristematic cambiform cells.

8. Where the wounds are deep-seated the vascular tissues may be involved in the reaction.

9. The reaction in such cases takes the form of the development of secondary tracheids, usually short and of small calibre, which vary in position with that of the wound.

10. There is some evidence that the phloem or phloem-parenchyma may also become meristematic under these conditions.

I am much indebted to Dr. D. H. Scott, F.R.S., for his kindly interest during this investigation. Acknowledgments are also due to the Keeper of the Department of Geology, British Museum (Natural History), and to Prof. M. Drummond of Glasgow University for facilities for studying the fossil plants in their respective departments.

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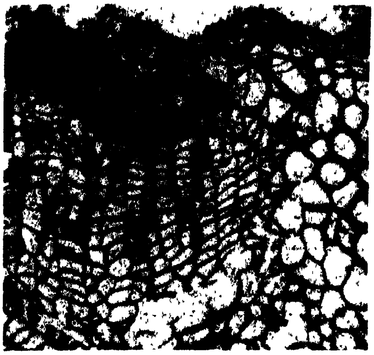

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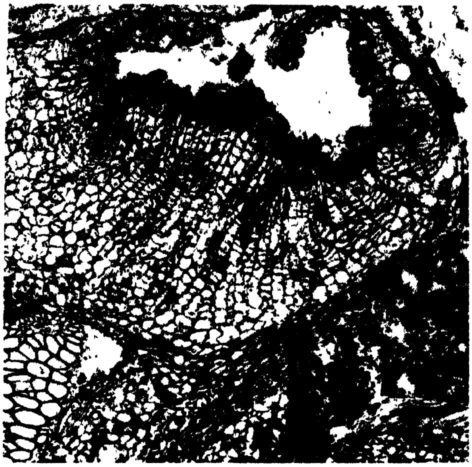

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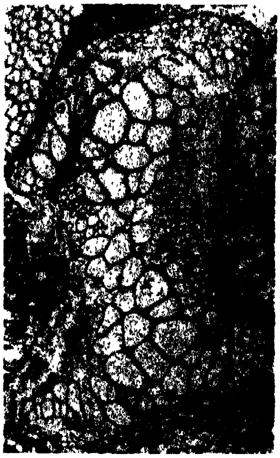

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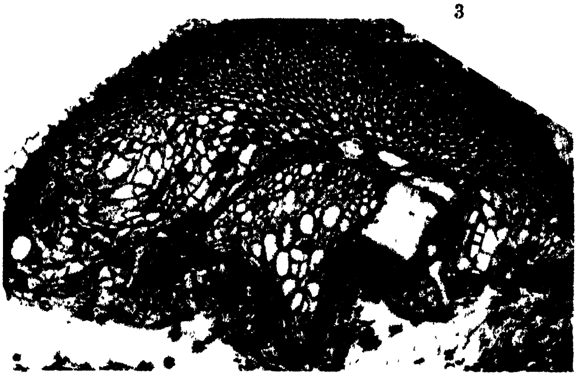

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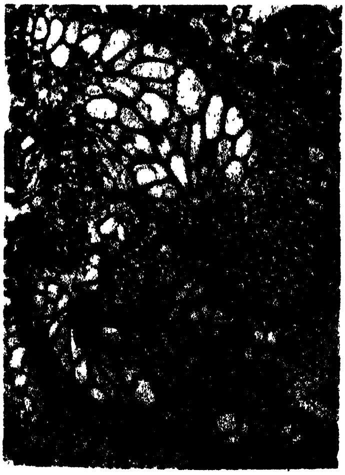

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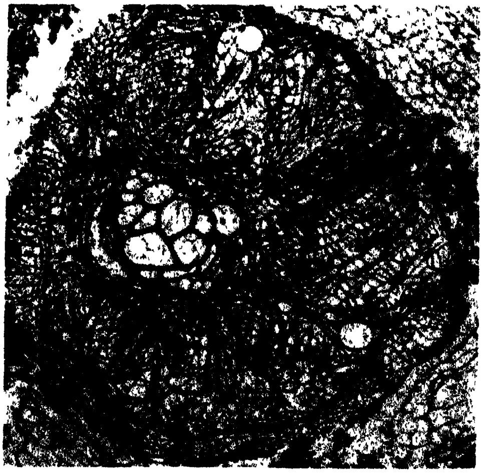

1

WOUND REACTIONS OF ANKYROPTERIS CORRUGATA.

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EXPLANATION OF PLATE 38.

(All the figures are from untouched negatives.)

Fig. 1. Transverse section of a wounded root showing the superficial periderm which is characteristic of *Ankyropteris corrugata* and the formation of irregular wedges of cortical meristem. × 80. University College (Nottingham) Coll. 261.76.

2. Transverse section of the petiolar cortex showing well-developed wound meristem. Note the divisions in the thick-walled cells to the right in the upper portion of the figure. × 100. University College (Nottingham) Coll.

3. Transverse section of a portion of a wounded petiole showing the wound meristem divided into an outer (dark) and an inner (pale) zone. × 40. Kidston Coll. 2033.

4. Transverse section of a wounded petiole showing the elongation of the cells of the cortical parenchyma towards the injured surface and their subdivision. The small protoxylem groups lying inside the peripheral loop are well shown. × 40. University College (Nottingham) Coll. 153.0.

5. Transverse section of the stele of a wounded petiole showing a well-developed strip of small secondary tracheids on the right of the central bar and a small group on the left. × 40. Kidston Coll. 1675.

6. Transverse section of a wounded petiole showing the central bar replaced by irregular parenchyma with a strip of secondary tracheids to the left and secondary phloem to the right. A broad strip of secondary tracheids is associated with the right side of the upper peripheral loop. × 40. University College (Nottingham) Coll. 261.70.

On the Cuticles of some Recent and Fossil Myrtaceæ.

By HELENA BANDULSKA, A.R.C.S., M.Sc., Ph.D., F.L.S.

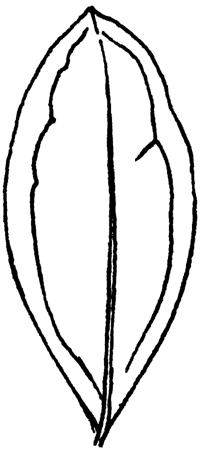
(PLATES 39 & 40, and 24 Text-figures.)

[Read 23rd October, 1930.]

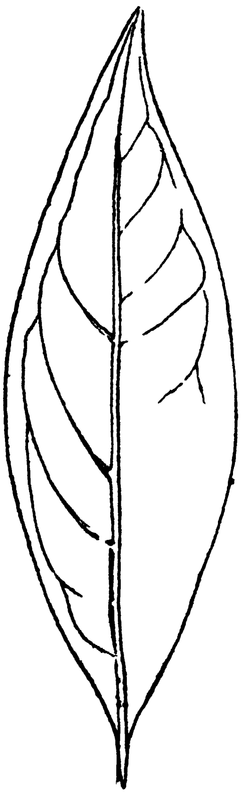
Genus RHODOMYRTUS Reichburg.

General Characters of the Leaf.—There is great variety of leaf length, ranging from 25 cm. (*R. macrocarpa*) to 2·4 cm. (*R. tomentosa*, text-fig. 1). The leaves are simple and entire and may be elliptical (*R. surigavensis*, text-fig. 2; *R. tomentosa*), ovate-elliptical, ovate-lanceolate (*R. psidioides*, text-fig. 3), oblong, or obovate (*R. macrocarpa*). Their apices may be acute acuminate or obtuse. The lamina and petiole may taper into each other or lamina and petiole may

TEXT-FIG. 1.



TEXT-FIG. 2.



TEXT-FIG. 3.

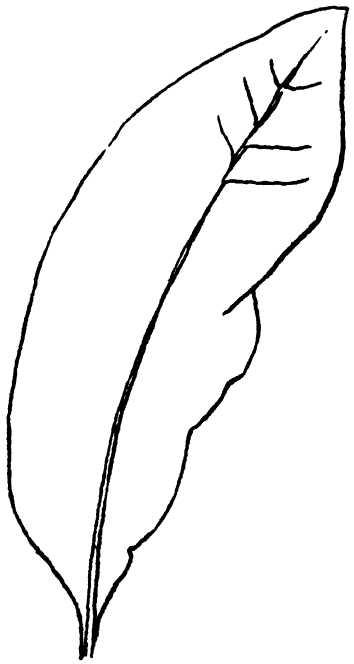
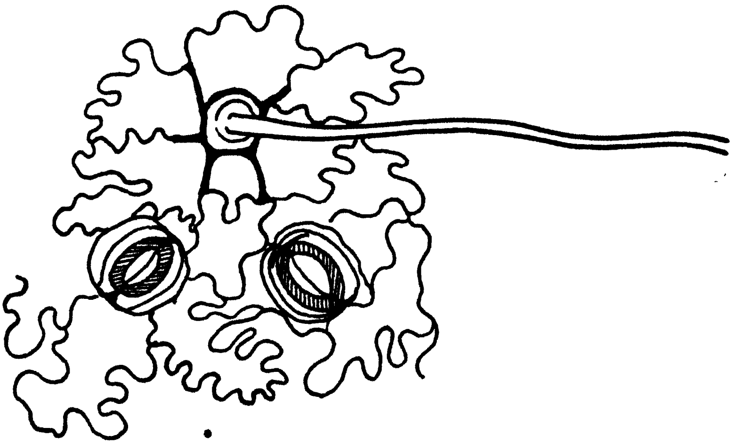


Fig. 1.—*Rhodomyrtus tomentosa.*
Fig. 2.—*Rhodomyrtus surigavensis.*
Fig. 3.—*Rhodomyrtus psidioides.*

be sharply demarcated. The venation may be pinnate (*R. psidioides*) and the number of secondary veins may be from six to twelve or two secondaries may arise from the base of the blade giving it a trinerved character (*R. trineura*), but above these there are then a few pinnately arranged secondaries (*R. tomentosa*). Frequently the venation of the upper surface is very obscure, and thus as in the genus *Tristania* the venation is not very helpful in palæobotanical work. The whole genus comprises trees and shrubs whose leaves are evergreen and more or less tomentose, the hairs being unicellular or uniseriate. Small resinous glands are found beneath the epidermis.

General Characters of the Cuticles.—The lower epidermal cells have sinuate walls in every species examined. Hairs or hair-bases occur in all, and the latter may appear as a thickly cutinised collar from which radial spikes of cutin project (*R. trineura*, text-fig. 4; *R. surigavensis*).

TEXT-FIG. 4.



Rhodomyrtus trineura, showing two stomata.

Note.—The cutinised T-piece at junctions of guard-cells and their thin outer walls bordered by ill-defined subsidiary cells, also the thickoned poral rims. Collar-like hair-base.

The stomata are superficial, *i. e.*, not much below the surface, and of variable size, elliptical, generally longer than wide though not universally so (Pl. **39**. fig. 7). Scales seen as cuticular hooks in section (*R. surigavensis*) arise from the upper surface of the guard-cells and arch over the pore (Pl. **39**. figs. 3, 4; text-figs. 5–7). The guard-cells have thin outer walls and slightly or moderately thickened junctions, a T-shaped cutinisation showing at each pole of their long axis. Their inner rims are cutinised and exhibit a wide deeply stained border beyond the cutinised edge. Narrow paired subsidiary cells, sometimes ill defined or invisible, may occur parallel to the guard-cells. The contents of the former may be granular and stain deeply or they may be colourless. Rarely, a few isolated stomata are seen on the upper epidermis (*R. psidioides*). These are probably a traumatic phenomenon.

FOSSIL SPECIES.

RHODOMYRTUS SINUATA (Band.), comb. nov. (Pl. 39. figs. 1, 2, 4, 5, 8; text-figs. 8–11.)

Dicotylophyllum sinuatum Bandulska.

Occurrence.—Middle Eocene of Bournemouth, between Durley and Alum Chines.

A large number of specimens both complete and fragmentary have been found; it is one of the commonest fossils in these beds. In an earlier paper (Bandulska, 1923) I described this leaf as *Dicotylophyllum sinuatum*, as its affinities were then unknown. It is here referred to the genus *Rhodomyrtus*; all the dicotyledonous leaves described in the 1923 paper have now been placed in known genera.

External Characters (Pl. 39. figs. 1, 3).—Length varies between 9 and 10 cm. Width varies from 2–5 cm. Shape ovate-lanceolate to lanceolate. Apex acute, base tapering and cuneate as is also so common in recent species of *Rhodomyrtus*. Margin entire with an occasional notch. Recent species, e. g., *R. psidioides* (text-fig. 3) also exhibit this peculiarity. Venation unicostate with a strong midrib and extremely delicate secondaries mostly paired, though some are close together but not quite opposite. The secondary veins show a tendency to unite together peripherally to form a sympodial vein parallel to the margin (see text-fig. 11). This is also seen in some recent species of *Rhodomyrtus*, e. g. *R. surigavensis* (text-fig. 2).

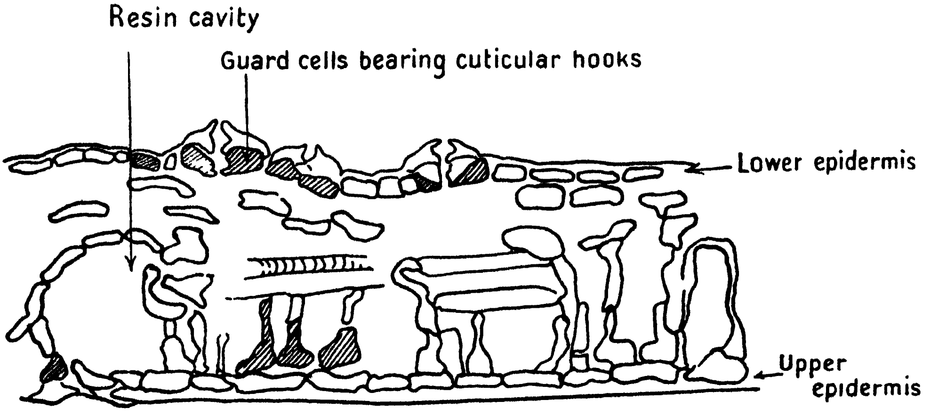
Cuticular Structure.

Lower Epidermis (Pl. 39. figs. 4, 5).—Epidermal cells sinuate walled and varying in size and shape.

Stomata usually slightly longer than broad, differing much in size and poral width. The outer walls of the guard-cells are delicate and show a tendency to break down. This obtains in recent species too. The poral rim has a narrowly cuticularised edge, and there is a wide border to the rim staining more deeply than the rest of the guard-cells. The pore is open or closed in by scales in all respects similar to those of the recent species, but here and there showing different stages in disintegration. The junctions of the guard-cells exhibit a well-marked cuticularised T-piece at each pole. They commonly show a somewhat irregular narrow parallel bordering cell on either side, which may stain deeply or not at all and which is not always obvious. Isolated "giant" stomata are seen occasionally associated with venules. Elongated narrow cells with slightly sinuate walls constitute the venules, and among them are cutinised thick-walled hair-bases often raised like a collar above the surface-level. Hair-bases are not, however, limited to the venules, but occur in the epidermal parenchyma, though less abundantly. Six to eight epidermal cells are radiately grouped round them, and the amount of cutinisation of the "collar" and adjacent cells varies.

Upper Epidermis (Pl. 39. fig. 2) consists of more regular small cells with sinuate walls. There are no stomata on the upper surface, but slit-like openings of what appear to be secretory cavities are sometimes seen.

TEXT-FIG. 5.



TEXT-FIG. 6.

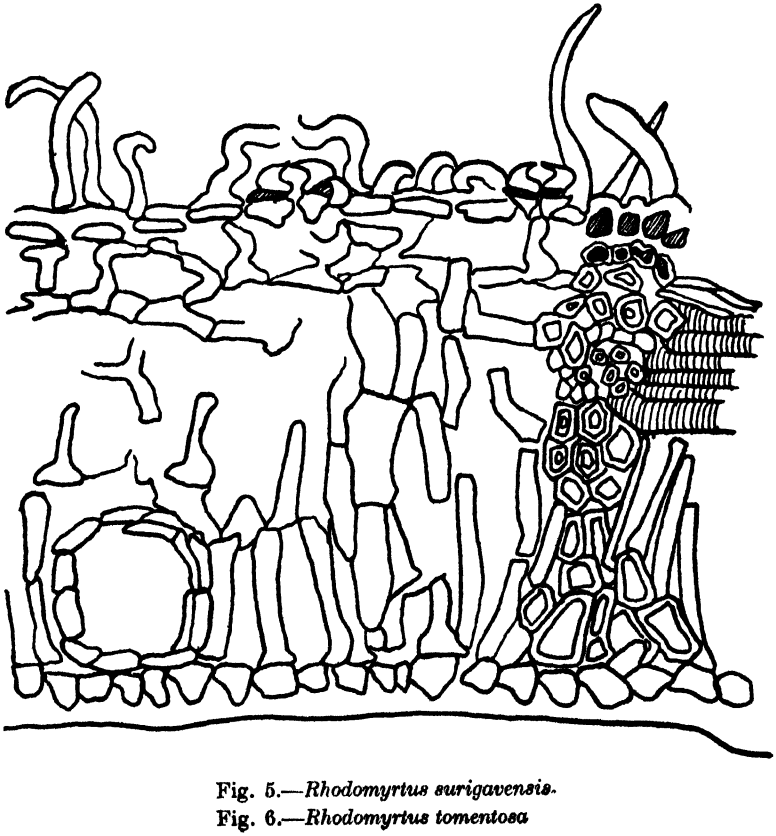
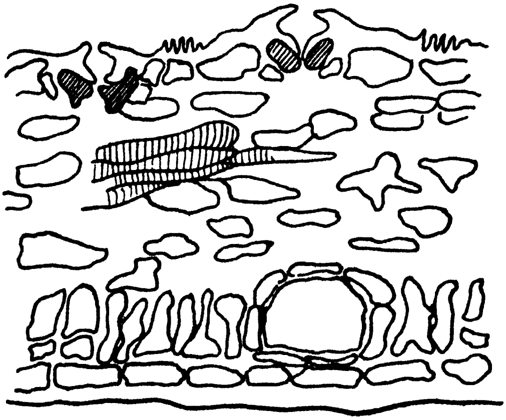
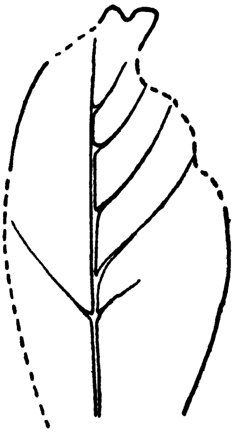


Fig. 5.—*Rhodomyrtus surigavensis.*
Fig. 6.—*Rhodomyrtus tomentosa*

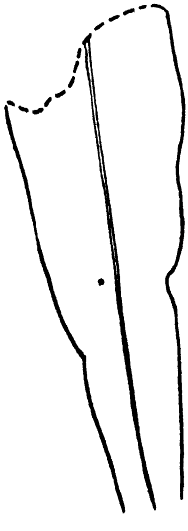
TEXT-FIG. 7.



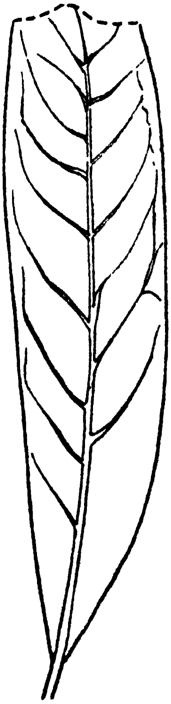
TEXT-FIG. 8.



TEXT-FIG. 9.



TEXT-FIG. 11.



TEXT-FIG. 10.

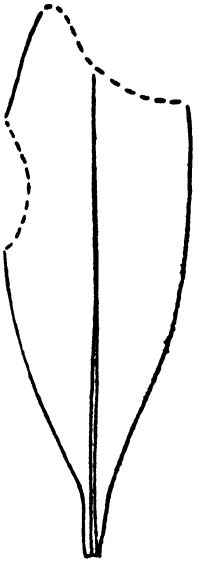
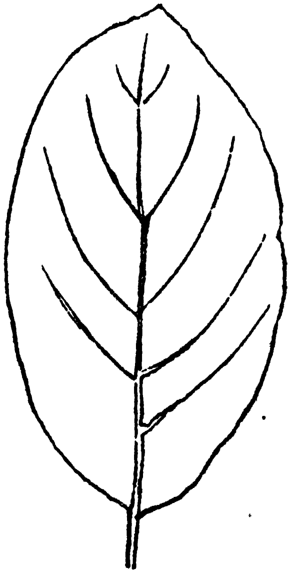


Fig. 7.—*Rhodomyrtus psidioides.*
Figs. 8–11.—*Rhodomyrtus sinuata.*

DISCUSSION.

The fossil *Rhodomyrtus* leaf described agrees in general size, type of venation, the ovate-lanceolate to lanceolate shape, the tapering base, and entire, occasionally notched margin with several recent species of this genus. It will be seen from the preceding description that the cuticular structure of the fossil agrees very closely with the characters of the living species. It is necessary to take into account the sum of all the characters, but the following should be particularly noted. The guard-cells have thin outer walls, and within the cutinised edge to the poral rim they have a deeply staining wide border concentric with the rim. Their junctions are cutinised, the cutinisations forming a T-piece at each extremity of their long axis. Here and there much larger "giant" stomata, different in appearance from the rest, may be seen. The guard-cells are superficial, of variable size, and usually elliptical shape, bearing scale-rimmed pores. Cutinised hair-bases occur among the sinuate-walled cells of the lower epidermis.

TEXT-FIG. 12.



Tristania suaveolens.

Genus TRISTANIA R. Brown.

General Characters of the Leaf.—The genus includes shrubs and trees with simple alternate coriaceous glabrous leaves, sessile or sharply petioled (*T. mangayi*; *T. suaveolens*, text-fig. 12; *T. pectioides*; *T. neriifolia*, text-fig. 13) or narrowing gradually in a petiole (*T. laurina*, text-fig. 14; *T. burmannica*, *T. conferta*). They are lanceolate (*T. neriifolia*, text-fig. 13), ovate (*T. suaveolens*, text-fig 12), or obovate (*T. pectioides*), and all are exstipulate. Their margin is entire with an occasional notch (*T. laurina*, *T. conferta*), and the leaf may be slightly asymmetrical (*T. laurina*, text-fig. 14; *T. conferta*) owing to the acute apex becoming somewhat curved or sickle-shaped (*T. laurina, T. conferta*). More rarely is the apex obtuse (*T. obovata*). The pinnately arranged veins vary in number and in clearness of outline. They may be very numerous (*T. laurina, T. burmannica*) or relatively few and wide apart (*T. conferta, T. pectioides*, and some forms of *T. laurina*), and this variability is even exhibited by the same species (*T. laurina*). The venation in this genus is therefore not very helpful in palæobotanical work, especially as after drying even in recent species the veins may become very obscure (*T. neriifolia*). When the secondary veins are distinct they sometimes curve just inside the margin to form a sympodial vein which pursues an upward course parallel to the leaf edge. In some species the secondaries on the same side of the midrib are alternately strongly and faintly marked (*T. suaveolens*). The length of the blade of different species varies from 8 cm. to 20 cm., and the width from 2·5 cm. to 1·2 cm. The average angle made by the secondaries with the midrib is 30°.

TEXT-FIGS. 13 & 14.

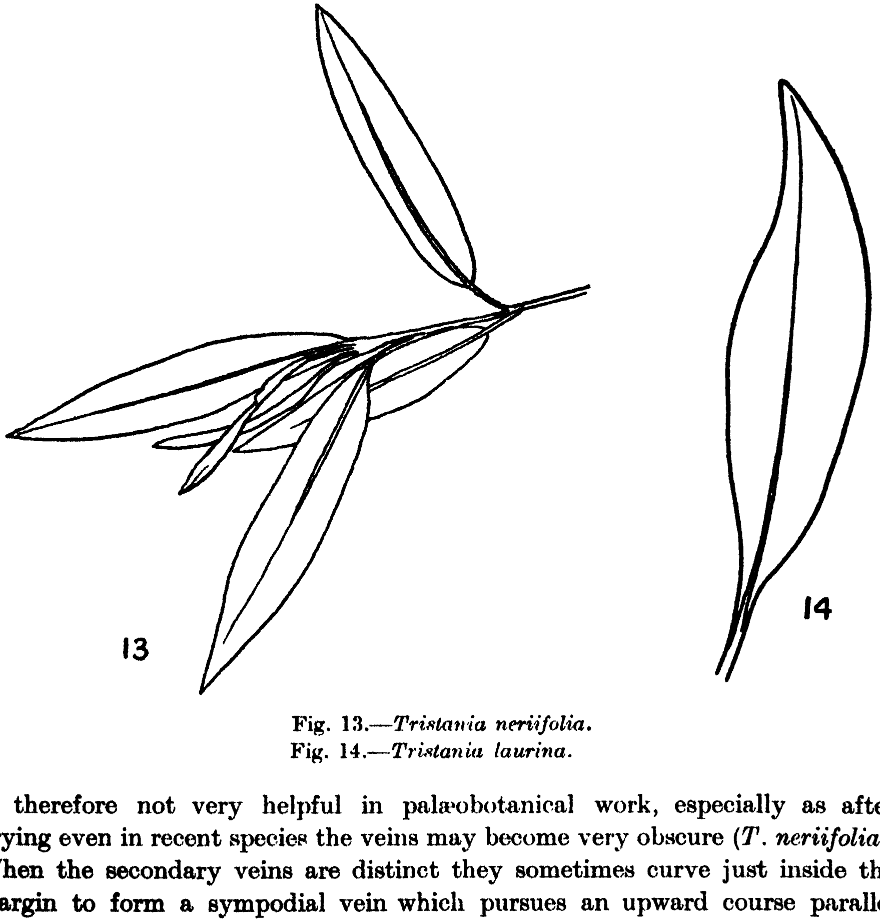
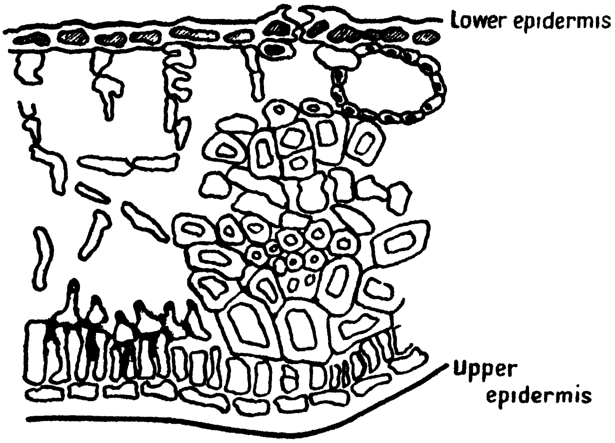


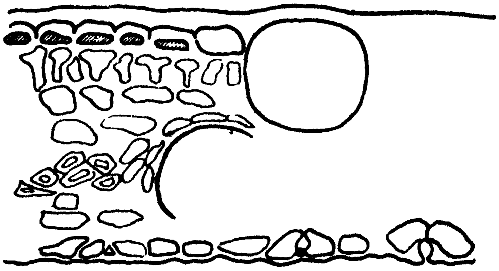
Fig. 13.—*Tristania neriifolia.*
Fig. 14.—*Tristania laurina.*

General Characters of Cuticles.—The very numerous stomata (Pl. 40. fig. 16) are superficial (text-figs. 18, 21) or only slightly depressed, but are efficiently protected by unicellular hairs or incurved cuticular hooks or scales on the

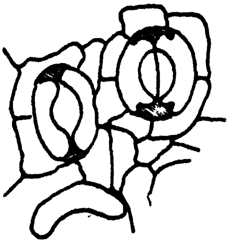
TEXT-FIG. 15.



TEXT-FIG. 16.



TEXT-FIG. 17.



TEXT-FIG. 18.

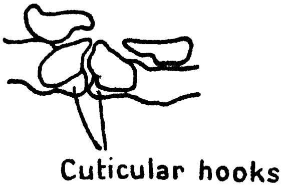
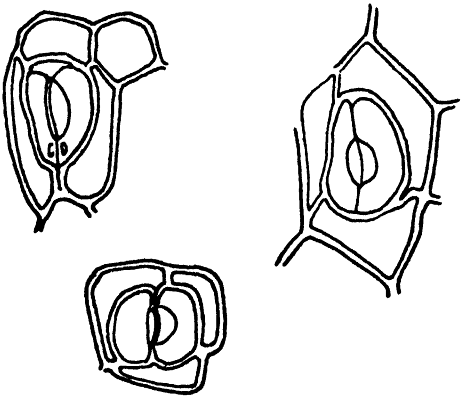


Fig. 15.—Vertical section through leaf of *Tristania burmannica*.
Fig. 16.—*Tristania suaveolens*. Vertical section through leaf showing stoma.
Fig. 17.—Stomata of *Tristania* showing cutinisation at the poles.
Fig. 18.—Section of stoma showing cuticular hooks.

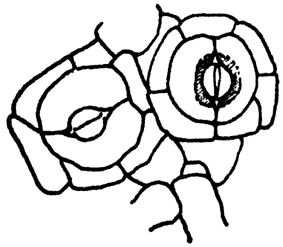
poral rim or arising from the hooks of the guard-cells, which may more or less cover in the pore in surface-view (*T. burmannica*; *T. laurina*, text-figs. 15, 24). The junctions of the guard-cells are delicate, but some species show a slight, very narrow dagger-shaped cutinisation which may broaden towards the poles or towards the pore (text-fig. 17). The stomata may be oblong or nearly or quite isodiametric, but quite often some are a little longer than broad, and they are slightly variable in size, with an average diameter when isodiametric

TEXT-FIG. 19.



TEXT-FIG. 20.

Two stomata in surface view



TEXT-FIG. 21.

Tristania mangayi
vertical section through
stoma

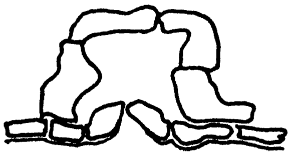
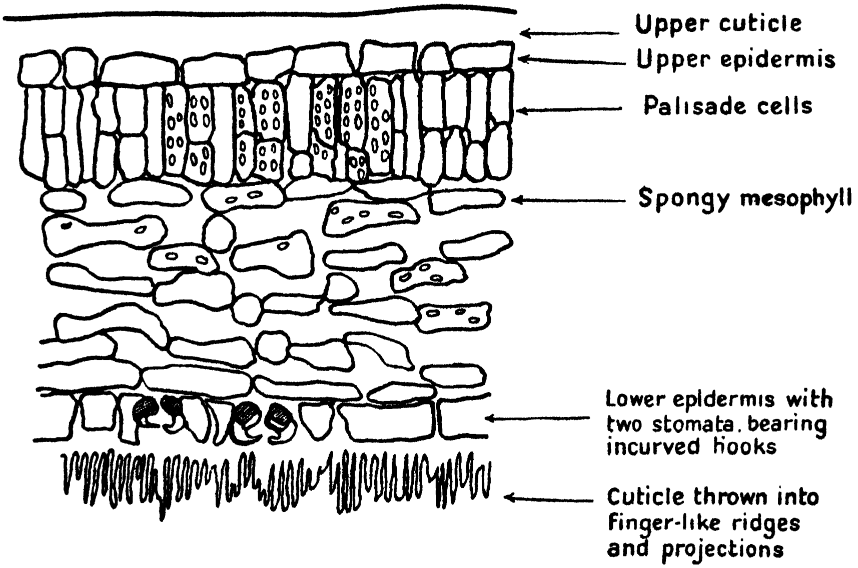


Fig. 19.—*Tristania neriifolia.*
Figs. 20 & 21.—*Tristania mangayi.*

of ·022 mm. (Pl. 40, fig. 12). In some species there are a few isolated " giant " stomata each surrounded by two or three rows of radiating concentric cells (*T. suaveolens*, *T. mangayi*, *T. burmannica*). Girdling epidermal cells varying in size and shape in the same girdle and which in some species are much narrower than the rest of the epidermal parenchyma enclose the stomata, and, while there may be as few as three of these cells (*T. neriifolia*, text-fig. 19), there are generally seven or eight (*T. mangayi*, text-fig. 20; *T. suaveolens*, *T. laurina*).

There is a variable amount of parenchyma apart from these girdle-cells, owing to the close juxtaposition of the stomata. In some species the epidermal walls are straight or sinuate, the most markedly sinuate parenchyma occurring in *T. laurina*, where also the parenchyma is most abundant (Pl. 40. fig. 13). Hair-bases are common, but abundant hairs only occur in *T. laurina*. The *upper epidermis* lacks stomata and consists of small cells with straight or sinuate walls (Pl. 40. fig. 14). There are slit-like cavities in the upper epidermis of all the species examined either scattered indiscriminately or occurring in definite little groups, and apparently formed by the separation of adjacent cells. These cavities are of variable size and shape ; they are sometimes almost circular, sometimes tortuous, and have thick almost sclerosed walls. Less frequently these cavities are found in the lower epidermis (not in *T. laurina*, *T. mangayi*, *T. neriifolia*). They are always quite distinct from the hair-bases.

TEXT-FIG. 22.


Upper cuticle
Upper epidermis
Palisade cells
Spongy mesophyll
Lower epidermis with two stomata, bearing incurved hooks
Cuticle thrown into finger-like ridges and projections

Tristania neriifolia.

Both upper and lower epidermis are densely cutinised, and the cutin may show striations (*T. burmannica* ; *T. neriifolia*, text-fig. 22).

FOSSIL SPECIES.

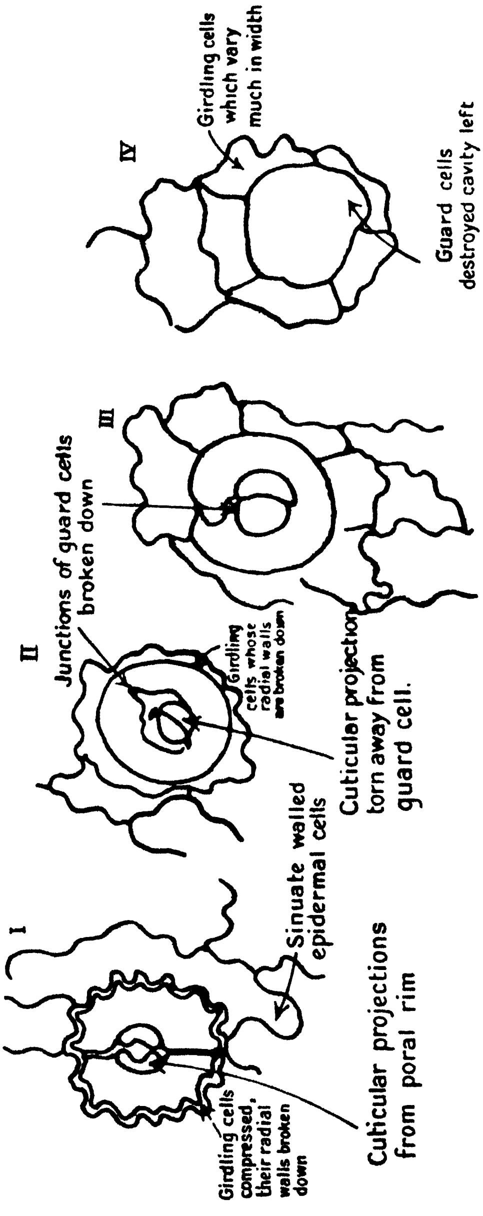
TRISTANIA BOURNENSIS, sp. n. (Pl. 40. fig. 15.)

Occurrence.—Bournemouth Eocene Beds.

Locality.—Between Alum and Middle Chines, Bournemouth.

The specimen described is the basal half of a large ovate-lanceolate leaf which fell to fragments before its outline could be sketched, but which had well-preserved cuticle.

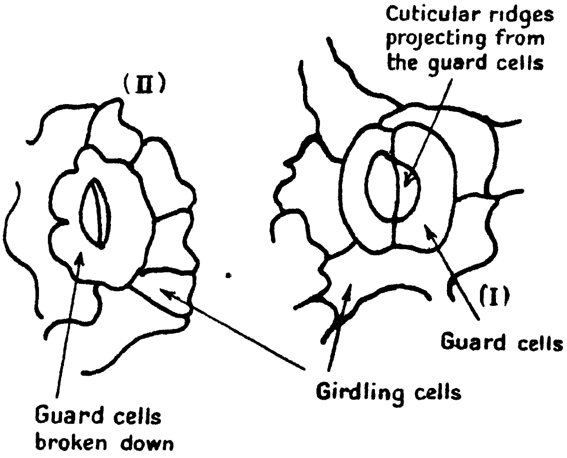
TEXT-FIG. 23.


I
Girdling cells compressed, their radial walls broken down
Cuticular projections from poral rim
Sinuate walled epidermal cells
II
Junctions of guard cells broken down
Girdling cells whose radial walls are broken down
Cuticular projection torn away from guard cell.
III
IV
Girdling cells which vary much in width
Guard cells destroyed cavity left

Guard-cells of *Tristania toscana*, sp. n.

Lower Epidermis (Pl. 40. fig. 15).—The stomata are abundant and superficial. Incurved scales much like those of the recent *T. laurina* (text-fig. 24) and *T. burmannica* (Pl. 40. fig. 16) arch over the pores. The guard-cells vary in size and may be oblong or isodiametric as in recent species. The isodiametric guard-cells have an average diameter of ·022 mm., while the long axes of the oblong ones vary between ·025 mm. and ·030 mm. In all cases girdling parenchyma encloses the stomata, the girdle-cells varying in size and number and being often narrower than the scantily developed cells between one stoma and the next. The fossil occupies an intermediate position as regards these girdle-cells between *T. laurina* (Pl. 40. fig. 17) and *T. burmannica*, for there is more distinction between girdle and adjacent parenchyma in the fossil than in *T. laurina* and less distinction between girdle-cells and adjacent parenchyma than in *T. burmannica*. The junctions of the guard-cells are delicate. This is also the case in *T. laurina* (Pl. 40. fig. 13).

TEXT-FIG. 24.



Tristania laurina.

Basal portions of tubular unicellular hairs arise from radiating groups of parenchyma and are similar in appearance to those seen in *T. laurina*. Twin hairs may be seen springing from one group of radiating cells.

Upper Epidermis.—Angular straight-walled parenchyma constitutes the upper epidermis. Circular and slit-like cavities are seen in it similar to those found in various recent species of *Tristania.*

TRISTANIA TOSCANA, sp. n. (Pl. 40. figs. 9–11.) (B.M. (N.H.), no. V. 3810.)

Occurrence.—Pliocene beds of Tuscany.

Locality.—Mt. Calvi.

The described specimen is a leaf-blade (V. 3810 *a*) from the Castelli Collection in the British Museum, Department of Geology.

It has been labelled in manuscript " *Persea speciosa* Heer," but there is no evidence to connect it with any known example of this genus, and the cuticle is quite unlike that of a *Persea* or indeed of any of the examined Lauraceæ, while its general characters are in agreement with those of several recent species of *Tristania.*

External Characters (Pl. 40. fig. 9).—Leaf simple; length 6·75 cm. with a small fragment of the apex missing. Width 2·7 cm., greatest in the middle. Shape elliptical-lanceolate. Venation unicostate, with strongly marked midrib and very delicate laterals, the latter slightly alternate or almost paired, seven showing on the right and eight on the left of the midrib, some obliterated near the apex. Margin entire.

Cuticular Structure. (Pl. 40. figs. 10, 11.)

Lower Epidermis.—The superficial and approximately isodiametric thin-walled guard-cells bound a small pore whose rim is protected by paired cuticular projections. The delicate junctions of the guard-cells have often broken down and then the cuticular projections on the poral rim are visible, enclosed by two concentric circles (see text-fig. 23, I, II, III, IV), while now and again the guard-cells are entirely obliterated, leaving a space (text-fig. 23, IV) enclosed by girdling cells, which are very distinctive and always surround the stomata—this may be seen occasionally in the recent species *T. laurina* (text-fig. 24, I, II). Most of these encircling cells are very narrow, so that their cavities and inner and outer walls resemble a thick rim rather than a ring of cells round each stoma. This deceptive appearance is further heightened by the fact that many of these girdling cells have lost their radial walls during fossilisation. Here and there a girdle may include one or two wider cells as constituent elements or more rarely all may be wider than the average. The girdle-cells are further distinguished by their deep staining, when they are compared with guard-cells and epidermal cells.

The sinuate-walled epidermal cells are but sparsely distributed between the very numerous stomata. Collar-like hair-bases with thickened and spiked cuticular rims occur on the venules. The upper epidermis is missing.

DISCUSSION.

The present investigation demonstrates the presence of one species of *Tristania* in the Bournemouth Eocene beds, and one species of *Tristania* in the Pliocene of Tuscany. The cuticular structure of both species is described.

Tristania bournensis resembles several recent species of *Tristania.* Its stomata are loosely scattered, and it agrees rather with *T. laurina* than with the other recent species under investigation in this feature. The fossil is characterised by superficial variable sometimes isodiametric stomata bearing cuticular scales. The guard-cells are surrounded by narrow girdling parenchyma. The average diameter of the isodiametric guard-cells is ·022 mm. The lower epidermal cells have sinuate walls and bear tubular unicellular hairs.

The upper epidermis bears circular and slit-like cavities. The features described are typical of the recent *Tristania* leaves to which reference has been made in this paper.

A study of the characters of *Tristania toscana*, sp. n., shows that the fossil leaf resembles several recent species of *Tristania* both in form and venation. Its length, width, shape, slightly curved apex, and faintly marked paired, or almost paired, secondary veins springing from a strong midrib are all in agreement with recent species of *Tristania*.

Still better criteria of relationship are obtained from a comparative investigation of their cuticles, for the fossil and recent forms agree in the following characters :—

The stomata have superficial guard-cells with thin outer walls and thickened poral rims, the pore is protected by incurved projections of the cuticle, forming scales in surface-view. They are approximately isodiametric, with the same average diameter as in the recent species of *Tristania* examined. Because the stomata are so very numerous there is relatively little epidermal parenchyma, apart from the girdling cells which surround each stoma. Each girdle is composed of from three to seven very narrow cells which stain differently from the rest of the parenchyma. The epidermal cells in the fossil have sinuate walls as in the recent *T. laurina*. Collar-like hair-bases with spiked and cuticularised rims are present on the venules (cf. *T. burmannica*).

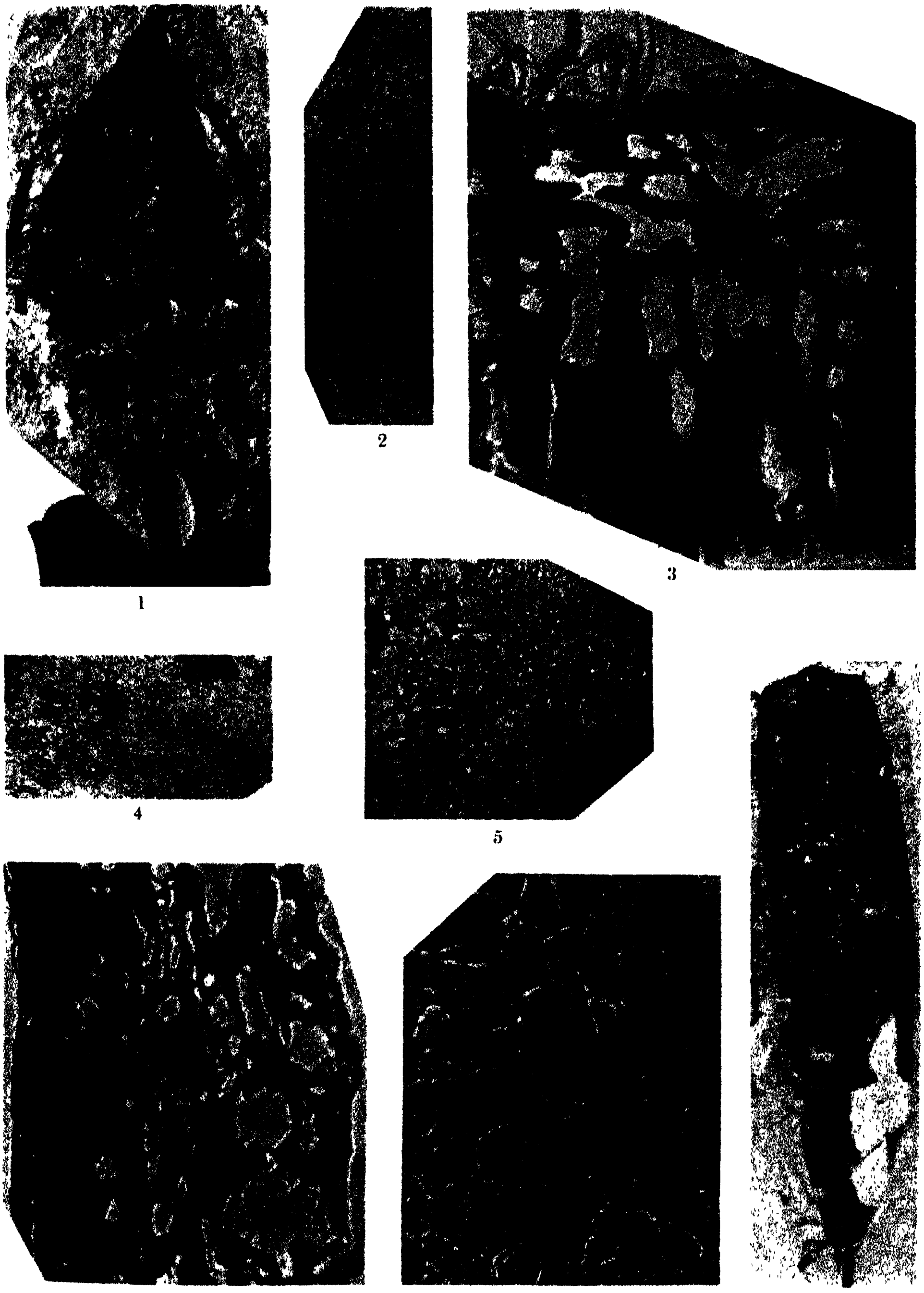
SUMMARY.

There is a strong family resemblance between the cuticles of *Rhodomyrtus* and *Tristania*, but the latter more frequently has isodiametric stomata and a larger number of narrow and very distinctive girdling cells encircling the guard-cells. There is, moreover, relatively less parenchyma and there are more stomata per unit of area in *Tristania* than in *Rhodomyrtus*. The presence of two genera belonging to such a typical Southern Hemisphere family as the Myrtaceæ in the Eocene of Bournemouth is a point of some interest. This investigation is not, however, the first to demonstrate their presence in Europe, for Mrs. Reid (1930) has described fruits and seeds of *Rhodomyrtus* from Tertiary beds of St. Tudy, Finistère, and the latter flora is also regarded as of Eocene age.

A cluster of fruits referred to *Tristanites* by Saporta has been found in the Oligocene of France. He also figures a leaf, and points out that, though its connection with the fruiting branch is doubtful, it agrees in form and venation with the recent genus *Tristania*. Schenk referring to the fossil fruits described by Saporta says that as far as one can judge from their external characters they show decided relationship to the Myrtaceæ. I know of no other fossil records of these genera except of two species of *Tristanites* recorded by Deane from the Miocene flora of Berwick, Australia.

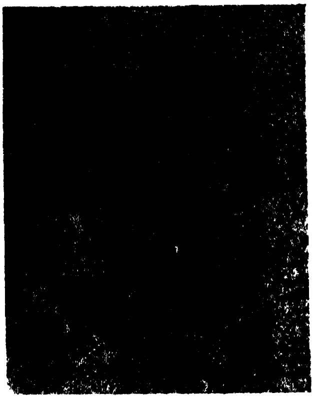
ACKNOWLEDGMENTS.

I have to thank Dr. Lang of the Department of Geology of the British Museum and Dr. Rendle of the Department of Botany for allowing me the use of these



CUTICLES OF RHODOMYRTUS SPP.

9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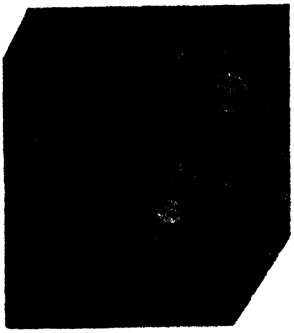
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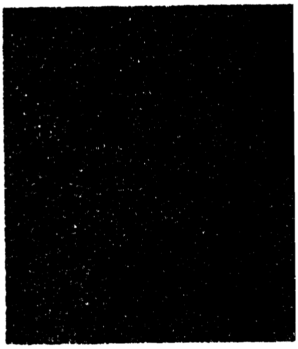
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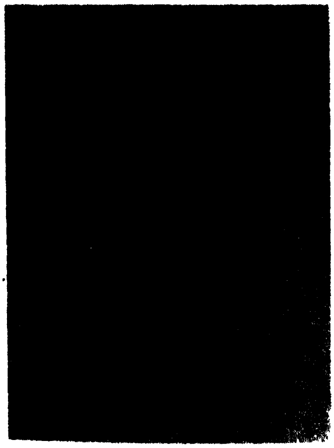
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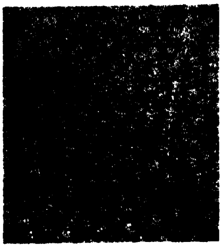
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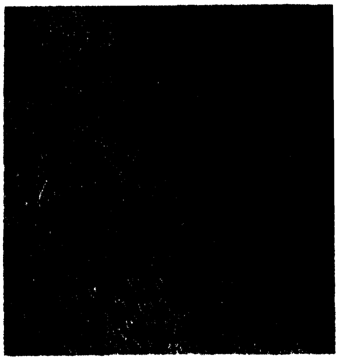
17

CUTICLES OF TRISTANIA SPP.

departments. The photographs in the paper are the work of Mr. F. W. Edwards and Mr. E. H. Ellis, and to these I offer my thanks. I owe much gratitude to Mr. W. N. Edwards for his stimulating and helpful criticism. I have to acknowledge again very gratefully a grant from the Royal Society in aid of the preparation of this paper.

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EXPLANATION OF THE PLATES.

Plate 39.

Fig. 1. *Rhodomyrtus sinuata*, sp. n. Upper half of leaf.

2. „ „ Cuticle of upper epidermis. × 135.

3. *Rhodomyrtus tomentosa*. Vertical section through leaf. Thick uneven lower cuticle. Epidermal cells narrow vertically acting as bases to unicellular hairs. Stomata protected by large cuticular hooks occur among the hairs.

4. *Rhodomyrtus sinuata*. Under epidermis. × 135.

5. „ „ Under epidermis. × 540. Stomata varying in size and poral width. Cuticularised "T"-piece at polar junctions of the guard-cells.

6. *Rhodomyrtus surigavensis*. Vertical section through leaf. Thickly cutinised lower epidermis of narrow elongated cells presenting an irregular papillate outline, owing to projection of numerous pairs of cuticular hooks over the guard-cells which close the pore. Resin-glands beneath epidermis.

7. *Rhodomyrtus macrocarpa*. Under epidermis. × 540. Hair-base with thickened radial walls. Stomata of variable size with cutinised poral rims and thickened "T"-piece at their junctions. Scales, seen as hooks in surface-view, close the pores. Ill-defined subsidiary cells.

8. *Rhodomyrtus sinuata*, sp. n. Natural size.

Plate 40.

Fig. 9. *Tristania toscana*, sp. n. Natural size.

10. „ „ Under epidermis. × 120.

11. „ „ Under epidermis. × 540.

12. *Tristania suaveolens*. Under epidermis. × 360. Stomata have thickened inner rim. Cutinised "T"-piece often three-pronged at poles. Four to seven narrow cells girdle each stoma. Scanty epidermal parenchyma.

13. *Tristania laurina*. Under epidermis. × 540.

14. „ „ Upper epidermis. × 135.

15. *Tristania bournensis*, sp. n. Under epidermis. × 540. Band. Coll. 453.

16. *Tristania burmannica*. Under epidermis. × 90.

17. *Tristania laurina*. Under epidermis. × 135.

INDEX.

[Synonyms and native names are printed in *italics*. A star * denotes the first publication of a name, and a dagger † denotes a fossil plant.]

Abies, 225.
— Webbiana *Lindl.*, 225.
Acanthus mollis, 634.
Acer caudatum *Wall.* var. ukurunduense *Rehd.*, 169.
— stachyophyllum *Hiern*, 169.
Achillea Millefolium, 117, 634.
— Ptarmica, 117, 634.
Achinetospora pusilla *Born.*, 238.
Acidanthera exscapa *Baker*, 21.
— flexuosa *Baker*, 22.
— tubulosa *Baker*, 17, mentd., 21.
Aconitum Franchetii *Fin. & Gagnep.*, mentd., 158.
— gymnandrum *Maxim.*, 157.
— lycoctonum, 634.
— naviculare *Stapf*, 157.
— soongaricum *Stapf* var. lasiocarpum *Marquand & Shaw* *, 158.
— tangense *Marquand & Shaw* *, 158.
— tatsienense *Fin. & Gagnep.*, mentd., 158.
— volubile *Pall.* var. latisectum *Regel*, 158.
Adenophora leptosepala *Diels*, 197.
Adhatoda Vasica *Nees*, 215.
Adiantum Capillus-Veneris, 634.
Adonis brevistyla *Franch.*, 155.
Adoxa, mentd., 334.
Ægopodium Podagraria, 117.
Æschynanthus bracteata *Wall.*, 214.
— levipes *C. B. Clarke*, 214.
Afra, 338.
Agapetes Lacei *Craib*, 197.
— præclara *Marquand* *, 197.
Agrimonia Eupatoria, 117, 634.
Agrostemma Githago, 117, 634.
Ajuga Chamæpitys, 634.
— genevensis, 117.
— reptans, 634.
Alaria, 234, 235, 241; mentd., 247, 250, 254.
— esculenta *Grev.*, 238.
— fistulosa, mentd., 248.
Albizzia Julibrissin *Durazz.* (?), 173.
— Lebbek, 419, 421, 425, 426.
Alchemilla vulgaris, 117, 634.
Aletris gracilis *Rendle*, 225.
Algacites filicoides Schlotheim †, 406, 407.
Alisma Plantago-aquatica, 117, 634.
Alliaria officinalis, 634.
Allium ascalonicum, 117.
— Cepa, 117, 634.
— Hookeri *Thwaites*, 226.
— Jacquemonti *Regel*, 226.
— kansuensis *Regel*, 226.
— oleraceum, 634.
— Porrum, 117, 634.
— sativum, 117, 634.
— Schœnoprasum, 634.
— Scorodoprasum, 117.
— ursinum, 117, 634.
— vineale, 634.
— yunnanense *Diels*, 226.
Alnus nepalensis, mentd., 431.
Aloe vera, 634.
Althæa officinalis, 117, 634.
— rosea, 634.
Ammi majus, 634.
— Visnaga, 634.

Anacamptis pyramidalis, 634.
Anacyclus Pyrethrum, 634.
Anacystis parasitica *Kütz.*, 236.
Anagallis arvensis, 117, 634.
— fœmina, 117, 634.
Anaphalis adnata *DC.* var. petiolata *Marquand & Shaw* *, 190.
— Royleana *DC.*, 190.
Anchusa azurea (italica), 634.
— officinalis, 117, 634.
Andrachne chinensis *Bunge*, 221.
Androsace adenocephala *Hand.-Mzt.*, 201.
— bisulca *Bur. & Franch.*, 201.
— erecta *Maxim.*, 201.
— geraniifolia *Watt.*, 201.
— mollis *Hand.-Mzt.*, 201.
— strigillosa *Franch.* var. canescens *Marquand* *, 201.
Anemone, mentd., 152.
— demissa *Hook. fil. & Thoms.*, 154.
— — var. grandiflora *Marquand & Shaw* *, 154.
— Hepatica, 117.
— nemorosa, 117, 634.
— obtusiloba *Don*, 154.
— Pulsatilla, 117, 634.
— ranunculoides, 634.
— rupestris *Wall.*, 154; mentd., 155.
— — var. pilosa *Marquand & Shaw* *, 154.
— — var. villosa *Marquand & Shaw* *, 154.
— trullifolia *Hook. fil. & Thoms.*, 154.
— — var. Souliei *Fin. & Gagnep.*, 154.
— Wardii *Marquand & Shaw* *, 155.
Anethum graveolens, 634.
Aneurophyta germanicum, mentd., 12.
Angelica sylvestris, 634.
Anisanthus splendens *Sweet*, mentd., 17.
Ankyropteris corrugata, Wound Reactions of (Holden), 643-655.
— westphaliensis, mentd., 650.
Anomatheca *cruenta* Lindl., 24.
— juncea, mentd., 30.
Anomozamites †, 395, 401, 402, 411-413.
— gracilis *Nath.* †, 410, 411.
— Hartzi *Harris* †, 411.
— marginatus *Nath.* †, 410.
— minor †, 411.
— Nilssoni †, 394, 410, 411.
Antennaria dioica, 634.
Anthemis Cotula, 117, 634.
— tinctoria, 634.
Antholyza, 17, 18.
— *æthiopica* Thunb., 17.
— caffra *Ker ex Baker*, 17.
— cunonia *Linn.*, 17.
— *cunonia* Thunb., 17.
— *fragrans* E. Meyer ex Klatt., 26.
— immarginata *Thunb. ex Baker*, 17.
— lucidor *Linn. fil.*, 17.
— *lucidor* Thunb., 17.
— *marginata* Thunb., 17.
— merianella *Linn.*, 25.
— *montana* Klatt, 26.
— *nemorosa* Klatt, 27.
— nervosa *Thunb.*, 18.
— *orchidiflora* Klatt, 26.
— *plicata* Linn. fil., 18.
— *plicata* Thunb., 18.
— præalta *Redouté*, 17.
— *ramosa* Klatt, 27.
— revoluta *Burm.*, 33.
— *ringens* Thunb., 18.
— *ringens* Linn., 18.
— *spathacea* Thunb., 18.
Anthriscus Cerefolium, 117, 634.
— sylvestris, 634.
Antithamnion cruciatum *Nag.*, 240.
— Plumula *Thur.*, 234, 240, 247.
Apios macrantha *Oliver*, 173.
Apium graveolens, 117, 634.
— Petroselinum, 117.
Aplotaxis sorocephala Schrenk, 193.
Aquilegia vulgaris, 634.
Arabidopsis himalaica *O. E. Schulz*, 162.
Aralia cissifolia *Griffith*, 185.
— pseudo-ginseng *Benth.*, 186.
Araucaria brasiliana, mentd., 453, 454, 457, 459, 462, 463.
— Cunninghamii, mentd., 456, 460, 462.
— excelsa, mentd., 454, 457, 459, 462.
— imbricata, mentd., 453, 454, 457, 459, 462, 463.
Archangelica officinalis, 117, 634.
Arctium Lappa, 634.
— minus, 117.
Ardagh, J., *see* Renkema, H. W.
Ardisia undulata *C. B. Clarke*, 201.
Arenaria Delavayi *Franch.*, 165.
— glanduligera *Edgew.*, 165.
— melandryoides *Edgew.*, 166.
— ramellata *Williams*, 166.
— serpyllifolia, 634.

Arenaria Stracheyi *Edgew.*, 166.
Arisæma flavum *Schott*, 228.
— Jacquemontii *Bl.*, 228.
— Wardii *Marquand & Shaw* *, 228.
Aristea africana *Hoffmannsegg*, 50.
— anceps *Eckl.*, 51.
— cærulea *Vahl*, 51.
— capitata *Ker*, 51.
— *cyanea* Ait., 50.
— dichotoma *Ker*, 52.
— Eckloni *Baker*, 51.
— *fruticosa* Pers., 47, 55.
— melaleuca *Ker*, mentd., 53.
— pusilla *Ker*, 54.
— spiralis *Ker*, mentd., 51, 54.
Aristolochia Clematitis, 117, 634.
Arnica retusa Wall., 278.
Artemisia Abrotanum, 117, 634.
— Absinthium, 117, 634.
— biennis *Willd.*, 190.
— pontica, 634.
— vulgaris, 117, 634.
Arum maculatum, 117, 634.
Aruncus sylvester, 634.
Arundinaria, 229.
Asarum europæum, 117, 634.
Ascidians, 234.
Ascidiella aspersa, 242.
Ascophyllum nodosum *Le Jol.*, 238, 252, 253.
Asparagus officinalis, 117.
— — var. altilis, 634.
Asperococcus echinatus *Grev.*, 237.
Asperula odorata, 117.
Aspidium, mentd., 325.
Asplenium, mentd., 330, 335.
— bulbiferum, 317, 318, 320, 330-332.
— Ruta-muraria, 117, 634.
— Trichomanes, 318, 320, 331, 332.
— viride, 634.
Aster Amellus, 634.
— tibeticus *Hook. fil.*, 189.
Astragalus floridus *Benth.*, mentd., 171.
— lessertioides *Benth.*, 171.
— tatsienensis *Bur. & Franch.*, 171.
— tribulifolius *Benth.* var. pauciflorus *Marquand & Shaw* *, 171.
— tumbatsica *Marquand & Shaw* *, 171.
— yunnanensis *Franch.*, 172.
Astrantia major, 634.
Asystasia macrocarpa *Nees*, 215.
Atriplex hortensis, 634.
— sp., 117.
Atropa Belladonna, 117, 634.
Avena sativa, 117, 634.
Aylmer Bourke Lambert and his 'Description of the Genus Pinus' (Renkema & Ardagh), 439-466.

Babiana disticha *Ker*, 28, 30.
— mucronata *Ker*, mentd., 28, 30.
— nana *Spreng.*, mentd., 29.
— obtusifolia, mentd., 29.
— plicata *Ker*, 28, 29.
— *reflexa* Eckl., mentd., 29, 30.
— ringens *Ker*, 18.
— sambucina *Ker*, mentd., 29.
— secunda *Ker*, 30.
— spathacea *Ker*, 30.
— stricta, *Ker ex Baker*, 28; mentd., 30.
— sulphurea *Ker*, mentd., 28.
— Thunbergii *Ker*, 18.
— tubiflora *Ker*, mentd., 30, 32.
— villosa *Ker*, mentd., 28.
Ballota nigra, 634.
Bandulska, H., A Cinnamon from the Bournemouth Eocene, 139-147: On the Cuticles of some Recent and Fossil Myrtaceæ, 657-671.
Barbarea vulgaris, 634.
Basigonia, 345, 346.
Begonia Griffithii *Hook. fil.*, 185.
Belemeanda chinensis *Lem.*, 51.
Béllière, M., *see* Leclercq.
Bellis perennis, 117, 634.
— — var. hortensis, 634.
Berberis aristata *DC.*, 159.
— concinna *Hook. fil.*, 159.
— mekongensis *W. W. Sm.*, 159.
— pallens *Franch.*, 159.
— pruinosa *Franch.*, 159.
— Silva-Taroucana *Schn.*, 159.
— sp. n. (?), 159.
— virescens *Hook. fil.*, 159.
— vulgaris, 117, 634.
Bergenia ligulata *Engl.*, 183.
— purpurascens *Engl.*, 183.
Beta vulgaris var. Cicla, 117, 634.
— — var. crassa, 634.
— — var. cruenta, 117, 634.

Betula, 418.
— japonica *Siebold* var. szechuanica *Schneid.*, 221.
Biology of Wood-rotting Fungi common in Forest Areas (S. R. Bose), 417-438.
Bobartia aphylla *Ker*, 50.
— filiformis *Ker*, 52.
— gladiata *Ker*, 51, 53.
— indica *Linn.*, 54.
— *Keetii* Phillips, 50.
— *spathacea* Ker, 54.
Bonnemaisonia asparagoides *Ag.*, 234, 239.
Borago officinalis, 117, 634.
Bose, S. R., Biology of Wood-rotting Fungi common in Forest Areas, 417-438.
Botanical Collection made by Captain F. Kingdon Ward in the Eastern Himalaya and Thibet in 1924-25 (C. V. B. Marquand), 149-230.
Botrychioloxylon paradoxum, mentd., 653.
Botrychium, mentd., 653.
— Lunaria, 634.
Brachystemma calycinum *D. Don*, 165.
Brassica campestris var. Rapa, 117.
— — — subvar. depressa, 634.
— — — subvar. oblonga, 634.
— Napus, 117, 634.
— — var. napobrassica, 634.
— oleracea var. acephala subvar. sabellica, 634.
— — — subvar. viridis, 634.
— — var. capitata, 117, 634.
Braya, 162.
— rosea *Bunge*, 162.
Brogniartella byssoides *Bory*, 234, 239.
Brown, N. E., Iridaceæ of Thunberg's Herbarium, 15-55.
Brunfels, Otto, the Herbal of (T. A. Sprague), 79-124; Index of Accepted Scientific Names of the Plants figured, 117-119; Index of Latin and German Names employed by Brunfels, 119-122.
Bryonia alba, 634.
Bryopsis plumosa *Ag.*, 237.
Bryum sp., 634.
Buddleia alternifolia *Maxim.*, 202.
— asiatica *Lour.*, 202.
— candida *Dunn*, 202.
— tibetica *W. W. Sm.*, 202.
Buddleia tsetangensis *Marquand* *, 202; mentd., 203.
— Wardii *Marquand* *, 203.
Bupleurum longicaule *Wall.*, 185.
— rotundifolium, 117, 634.
Buxus sempervirens *Linn.*, 220.
— — var. arborescens, 634.

Cæsalpinia pulcherrima, 419, 426, 427.
Cajanus indicus *Spreng.*, 173.
Calamophyton primævum, mentd., 12.
Calendula officinalis, 117, 634.
Calla palustris, 634.
Callithamnion byssoides *Schm.*, 240, 241.
— polyspermum *Ag.*, 235, 240.
— roseum *Harv.*, 240.
— scopulorum *Trail*, 240, 252, 254.
Callocolax neglectus *Schm.*, 239.
Callophyllis laciniata *Kütz.*, 239, 242.
Calluna vulgaris, 634.
Calothrix æruginea *Thur.*, 236, 253.
— confervicola *Ag.*, 236.
Calystegia sepium, 117, 634.
Campanula aristata *Wall.* var. longisepala *Marquand* *, 196.
— colorata *Wall.*, 196.
— pasumensis *Marquand* *, 196.
— Rapunculus, 117, 634.
— Trachelium, 634.
Cannabis sativa, 117, 634.
Capsella Bursa-pastoris, 117, 634.
Capsicum annuum, 634.
— cordiforme, 634.
— longum, 634.
Caragana, mentd., 149, 151.
— bicolor *Kom.*, mentd., 170.
— crassispina *Marquand* *, 170.
— Franchetiana *Kom.*, mentd., 170.
— jubata *Poir.*, 171.
— tibetica *Kom.*, 171.
Cardamine pratensis, 117, 634.
Cardiospermum Halicacabum, 634.
Carlina acaulis, 634.
— vulgaris, 117, 634.
Carthamus tinctorius, 117, 634.
Carum Carvi, 634.
Caryopteris Wallichiana *Schauer*, 215.
Cassia obovata, 634.
Cassiope fastigiata *D. Don*, mentd., 199.
— pectinata *Stapf*, mentd., 199.

Cassiope selaginoides *Hook. f. & Thoms.*, 199.
— Wardii *Marquand**, 199.
Castagnea virescens *Thur.*, 237.
Castanea sativa, 634.
Cavea tanguensis *W. W. Sm. & Small*, 193.
Celastrus Hookeri *Prain*, 169.
Celosia cristata, 634.
Centaurea Calcitrapa, 117.
— Cyanus, 117, 634.
Centaurium umbellatum, 117, 634.
Ceramium acanthonotum *Carm.*, 240.
— circinnatum *J. Ag.*, 240.
— diaphanum *Roth.*, 240.
— rubrum *Ag.*, 240.
Cerastium alpinum *Linn.*, 165.
Ceratostigma minus *Stapf*, 200.
Chætomorpha linum *Kutz.*, 236.
Champia parvula *Harv.*, 239.
Chantransia cæspitosa (*Batt.*), 238.
— Daviesii *Thur.*, 238.
— hallandica *Kylin* var. parvula *Rosenv.*, 238, 243, 250.
— virgatula *Thur.*, 238.
— — f. luxurians *Rosenv.*, 238.
— — f. secundata *Rosenv.*, 238
Chara *Linn.*, 134.
— Benthamii *Braun*, 134.
— brachypus *Braun*, 135.
— fragilis *Desv.*, 126, 135.
— *furcata* Bruzel, 132.
— gymnopitys *Braun*, 134.
— hydropitys *Reichb.*, 135.
— pseudo-brachypus *Groves & Stephens*, 126, 135.
— Roxburghii *Braun*, mentd., 132.
— vulgaris, mentd., 125.
— zeylanica *Willd.*, 136.
Charophyta collected by Mr. T. B. Blow in Madagascar (J. Groves), 125-138.
Cheiranthus Cheiri, 117, 634.
Chelidonium majus, 117, 634.
Chenopodium album, 634.
— Bonus-Henricus, 117, 634.
— Botrys, 634.
— polyspermum, 634.
— rubrum, 634.
Chondrus crispus *Stackh.*, 238, 252.
Chorda filum *Stackh.*, 237, 254, 255.
Chordaria flagelliformis *Ag.*, 237.
Choreonema Thuretii *Schm.*, 240.
Chrysanthemum *jugorum* W. W. Sm., 190.
— Leucanthemum, 117, 634.
— Parthenium, 117, 634.
— tatsienense *Bur. & Franch.*, 190.
— — var. tanacetopsis *W. W. Sm.*, 190.
Chylocladia articulata, 252.
— haliformis *Hook.*, 239.
Cicer arietinum, 117, 634.
Cichorium Endivia, 634.
— Intybus, 117, 634.
Cinchona, A Description of the Genus, by A. B. Lambert, mentd., 441.
Cineraria *reniformis* Spreng., 277.
— *retusa* Wall., 278.
— sibirica *Linn.*, 260.
Cinnamomum Burmanni *Blume*, 143, 144.
— Camphora *Nees & Eberm.*, 141 ; mentd., 140, 143-146.
— lanceolatum *Reid & Chandler* †, mentd., 139.
— obtusifolium *Nees*, mentd., 140.
— pauciflorum *Nees*, mentd., 140.
— Scheuchzeri *Reid & Chandler* †, mentd., 139.
— Wonnacotti *Bandulska** †, 141, 145, 146.
— zeylanicum *Nees*, 142 ; mentd., 143, 144.
Cinnamon from the Bournemouth Eocene (H. Bandulska), 139 147.
Cirsium acaule, 117.
Citrullus Colocynthis, 634.
— vulgaris, 634.
Cladophora, 241, 250, 251.
— arcta *Kutz.*, 237.
— gracilis *Kutz.*, 236 ; mentd., 246.
— lanosa *Kutz.*, 237.
— rupestris *Kutz.*, 235, 236 ; mentd., 243, 245, 246, 251-253.
— sericea *Kutz.*, 237.
Cladostephus spongiosus *Ag.*, 235, 237, 253.
Cleanthe *bicolor* Salisb., 53.
— lugens *Aschers. & Graeb.*, 53.
Clematis Forrestii *W. W. Sm.*, 152.
— graveolens *Lindl.*, 152.
— loasæfolia *DC.*, 152.
— montana *Ham.*, 153.
— orientalis *Linn.* var. acutifolia *Hook. fil. & Thoms.*, 153.
— Rehderiana *Craib*, 153.

Clematis urophylla *Franch.*, 153.
— Vitalba, 634.
Cnicus benedictus, 634.
— Souliei *Franch.*, 192.
Cochlearia Armoracia, 117, 634.
— scapiflora *Hook. fil. & Thoms.*, 162.
Codium mucronatum *J. Ag.* var. atlanticum *Cotton*, 235, 237, 250, 254.
Codonopsis convolvulacea *Kurz*, 194.
— cordifolia *Kom.*, 194.
— fœtens *Hook. fil. & Thoms.*, 195.
— lanceolata *Trautv.*, 195.
— ovata *Benth.*, 195.
— thalictrifolia *Wall.*, 195.
— viridis *Wall.* var. hirsuta *Chipp*, 195.
Colchicum autumnale, 117, 634.
Colutea arborescens, 634.
Compsothamnion gracillimum *Schm.*, 240, 247.
— thuyoides *Schm.*, 247.
Conchocelis rosea *Batt.*, 238, 242, 249.
Conium maculatum, 634.
Convallaria majalis, 117, 634.
Convolvulus arvensis, 634.
Corallina squamata *Ellis*, 235, 240.
Coriandrum sativum, 117, 634.
Cornus sanguinea, 117.
Cortia Hookeri *C. B. Clarke*, 185.
Corydalis Boweri *Hemsl.*, 160.
— cava, 117, 634.
— chrysosphæra *Marquand & Shaw* *, 160.
— Delavayi *Franch.*, mentd., 161.
— flaccida *Hook. fil. & Thoms.*, 160.
— Hendersoni *Hemsl.*, 160.
— juncea *Wall.*, 160.
— lupinoides *Marquand & Shaw* *, 160.
— meifolia *Wall.* var. cornutior *Marquand & Shaw* *, 161.
— — var. sikkimensis *Prain*, mentd., 161.
— mucronifera *Maxim.*, 160.
— scaberula *Maxim.*, 161.
— Wardii *Marquand & Shaw* *, 161.
Corylopsis sinensis *Hemsl.*, 185.
Corylus Avellana, 634.
— maxima, 634.
Cotoneaster multiflora *Bunge*, 176.
Crawfurdia Bulleyana *G. Forrest*, mentd., 203, 204.
— Trailliana *G. Forrest*, 203; mentd., 204.
— Wardii *Marquand* *, 203.
Cremanthodium *Benth.*, Taxonomy and Geography of the Sino-Himalayan Genus (R. D'O. Good), 259–316.
— acernum *R. Good* *, 284; mentd., 268, 285, 312.
— angustifolium *W. W. Sm.*, 190, 268, 296, 310.
— arnicoides *R. Good* *, 269, 288; mentd., 290, 307, 310.
— atrocapitatum *R. Good* *, 282; mentd., 268, 312.
— atroviolaceum *R. Good* *, 268, 286, 312.
— bulbilliferum *W. W. Smith*, 268, 272, 312.
— bupleurifolium *W. W. Sm.*, 191, 270, 298.
— calcicola *W. W. Sm.*, 268, 281, 312.
— *calotum* Diels, mentd., 300.
— campanulatum *Diels*, 267, 270, 310, 311.
— citriflorum *R. Good* *, 269, 277, 311, 312.
— *comptum* W. W. Sm., 191, 299.
— cremanthodioides *R. Good* *, 268, 279, 309, 312
— *cuculliferum* W. W. Sm., 297, 308, 309.
— cyclaminanthum *Hand.-Mazz.*, 268, 284, 312.
— *Deasyi* Hemsl., 300.
— Decaisnei *C. B. Clarke*, 191, 268, 273, 275, 307, 312.
— — f. Clarkei *R. Good* *, 275.
— — f. sinense *R. Good* *, 275.
— Delavayi *Diels*, 269, 277, 287, 311, 312.
— discoideum *Maxim.*, 268, 297, 308, 309.
— Farreri *W. W. Sm.*, 268, 276; mentd., 277, 311.
— *Fletcheri* Hemsl., 293.
— Forrestii *J. F. Jeff.*, 264, 268, 286, 312.
— *goringense* Hemsl., 293.
— gracillimum *W. W. Sm.*, 269, 273, 311.
— gypsophilum *R. Good* *, 269, 283, 312.
— Helianthus *W. W. Sm.*, 264, 267, 295; mentd., 296, 311.
— Hookeri *C. B. Clarke*, 263, 267, 268, 307, 308.
— — subsp. Clarkei *R. Good* *, 280.
— — — f. angustiligulatum *R. Good* *, 280.
— — — f. latiligulatum *R. Good* *, 280.
— — subsp. polycephalum *R. Good* *, 280.

Cremanthodium Hookeri *C. B. Clarke* subsp. polycephalum *R. Good** f. anomalum *R. Good**, 280, 281.
— — — f. irregulare *R. Good **, 280, 281.
— — — f. regulare *R. Good **, 280, 281.
— humile *Maxim.*, 270, 299, 309.
— *Larium* Hand.-Mazz., 270.
— *Limprichtii* Diels, 285.
— lineare *Maxim.*, 270, 291, 310.
— microcephalum *Hand.-Mazz.*, 268, 282.
— nanum *W. W. Sm.*, 270, 300, 307.
— nobile *Diels*, 270, 286, 292, 298, 312.
— oblongatum *C. B. Clarke*, 269, 287, 288, 298, 299, 307, 312.
— — var. *β*, 293.
— palmatum, *Benth.*, 268, 271, 309.
— — subsp. Benthami *R. Good **, 264, 271.
— — subsp. rhodocephalum *R. Good **, 268, 271, 310, 311.
— phœnicochætum *R. Good **, 268, 279, 312.
— pinnatifidum *Benth.*, 264, 268, 296, 309.
— plantagineum *Maxim.*, 264, 270, 288, 293, 306-308.
— — f. albidum *R. Good **, 293, 294.
— — f. Ellisii *R. Good **, 293, 294.
— — f. goringense *R. Good **, 293, 294, 307.
— — f. Maximowiczii *R. Good **, 293, 294.
— plantaginifolium *R. Good **, 262, 270, 291, 311.
— — subsp. Franchetii *R. Good**, 291.
— — — f. angustiligulatum *R. Good **, 291.
— — — f. Lagotis *R. Good**, 291.
— — — f. Winkleri *R. Good **, 292.
— — subsp. oligocephalum *R. Good**, 292.
— pleurocaule *R. Good **, 262, 270, 292, 310, 311.
— — f. Franchetii *R. Good **, 290.
— — f. uberrima *R. Good **, 290.
— Potanini *C. Winkl.*, 269, 285, 286, 310.
— Prattii *R. Good**, 269, 285, 310.
— Principis *R. Good **, 269, 283, 312.
— pseudo-oblongatum *R. Good **, 269, 284, 297; mentd., 298, 309.
— pulchrum *R. Good **, 269, 274, 311.
— reniforme *Benth.*, 268, 277, 309.
— retusum *R. Good**, 269, 278, 279, 282, 307, 309, 312.
— *rhodocephalum* Diels, 191, 271.
Cremanthodium rumicifolium *R. Good **, 269, 289, 310.
— scytophyllum *Diels*, 307.
— sino-oblongatum *R. Good **, 269, 288, 312.
— Smithianum *Hand.-Mazz.*, 268, 274.
— stenactium *Diels*, 270, 286, 295; mentd., 296, 310.
— suave *W. W. Sm.*, 264, 267, 296, 311.
— Thomsoni *C. B. Clarke*, 191, 269, 273, 308, 312; mentd., 274, 276, 297.
— variifolium *R. Good **, 269, 298, 312.
— Wardii *W. W. Sm.*, 267, 270, 311.
Crepis *bhotanica* Hutchinson, 194.
— depressa *Hook. fil. & Thoms.*, 194.
— Dubyæa *Marquand & Shaw**, 194.
— glomerata *Decne*, 194.
— — var. porphyrea *Marquand & Shaw **, 194.
— rapunculoides *Dunn*, 194.
— tectorum, 634.
— Umbrella *Franch.*, 194.
Crocus sativus var. officinalis, 635.
Cucumis Melo var. Cantalupo, 635.
— sativus, 635.
Cucurbita Pepo var. oblonga, 635.
— — var. rotunda, 635.
Cunninghamia sinensis, mentd., 457, 462.
Cupressus lusitanica, mentd., 452, 454, 457, 459, 462.
— nootkatensis, mentd., 453, 454, 457, 459, 462, 464.
— pendula, mentd., 449, 452, 454, 457, 459, 462.
— torulosa, mentd., 453, 454, 457, 459, 462, 463.
Cuscuta Epilinum, 635.
Cuticle Structure of Mesozoic Cycadean Fronds, Further Observations on the (H. Hamshaw Thomas), 389-416.
Cuticles of Cinnamomum, 144, 145.
Cyananthus inflatus *Hook. fil. & Thoms.*, 195.
— lobatus *Wall.*, 195.
— macrocalyx *Franch.* var. pilosus *Marquand*, mentd., 196.
— — var. flavo-purpureus *Marquand*, 195.
— petiolatus *Franch.*, 195.
— Wardii *Marquand **, 195.
Cyanophyceæ, 254.

Cycas revoluta, 323.
Cyclamen europæum, 635.
Cydonia oblonga, 635.
Cynanchum auriculatum *Royle*, 202.
Cynara Scolymus, 635.
Cynoglossum officinale, 117.
Cyperus longus, 635.
Cystoclonium purpureum *Batt.*, 239.
Cytisus scoparius, 117.

Dacrydium cupressinum, mentd., 452, 455, 457, 459, 462.
— distichum, mentd., 453, 455, 457, 459, 462, 463.
— excelsum, mentd., 458.
— plumosum (?), mentd., 458.
— taxifolium, mentd., 444, 453, 455, 457, 459, 462, 463.
Dammara australis, mentd., 453, 454, 457, 459, 462, 463.
— orientalis, mentd., 454, 457, 459, 462, 463.
Danthonia Raoulii var. rubra, 60.
Daphne Mezereum, 635.
Daphniphyllum himalayense *Muell.*, 220.
Datura Metel, 635.
Daucus Carota, 117.
— — (red form), 635.
— — (yellow form), 635.
— — var. silvestris, 635.
Delesseria alata *Lamour.*, 239, 252.
— ruscifolia *Lamour.*, 239.
— sanguinea *Lamour.*, 239.
— sinuosa *Grev.* var. lingulata *Ag.*, 234, 247, 255.
— — *Lamour.*, 239, 255.
— — f. lingulata *Ag.*, 239, 242.
Delphinium Consolida, 117, 635.
— glaciale *Hook. fil.* & *Thoms.*, 156.
— gyalanum *Marquand* & *Shaw* *, 156.
— lankongense *Franch.*, 156.
— Pylzowi *Maxim.*, 156.
— speciosum *M. Bieb.*, mentd., 156.
— Staphisagria, 635.
— tsarongense *Hand.-Mzt.*, mentd., 157.
— viscosum *Hook. fil.* & *Thoms.*, mentd., 157.
— Wardii *Marquand* & *Shaw* *, 157.
Dendrocalamus patellaris *Gamble*, 229.
Dermocarpa Leibleiniæ *Born.*, 236.
Desmarestia, mentd., 234.
Desmarestia aculeata *Lamour.*, 234, 237, 242.
Desmodium tiliæfolium *G. Don* var. genuinum *Schindler*, 172.
Deutzia corymbosa *R. Br.*, 183.
Dianthus carthusianorum, 117, 635.
— Caryophyllus, 635.
— superbus, 635.
Diapensia himalaica *Hook. fil.* & *Thoms.*, 200.
— Wardii *W. E. Evans*, 200.
Dicotylophyllum sinuatum Bandulska, 659.
Dictamnus albus, 117.
Dictyosiphon fœniculaceus *Grev.*, 237.
— hippuroides *Kutz.*, 237, 254.
Dictyota dichotoma *Lamour.*, 235, 238.
Dictyozamites †, 412.
Didissandra lanuginosa *C. B. Clarke*, 214.
— rufa *King*, 214.
Dierama pendula *Baker*, 49.
Dietes, 15.
— bicolor *Sweet*, 35, 36.
— *catenulata* Klatt, 36.
— *catenulata* Sweet, 36.
— *compressa* Klatt, 36.
— *crassifolia*, Sweet, 36.
— grandiflora *N. E. Brown* *, 35.
— *iridifolia* Salisb., 36.
— *iridioides* Sweet, 36.
— prolongata *N. E. Brown* *, 35, 37.
— — var. Galpini *N. E. Brown* *, 35, 37.
— vegeta *N. E. Brown* *, 34-36, 42, 53.
Digitalis ambigua, 635.
— purpurea, 635.
Dilsea edulis *Stackh.*, 240, 242.
Dioonites †, 393-395, 401.
— Andræanus †, 404.
— *Bavieri* Krasser †, 403.
— Dunkerianus *Goepp.* †, 393.
— *Nathorsti* Seward †, 393, 404, 412.
— rigidus †, 392.
Diplarche multiflora *Hook. fil.* & *Thoms.*, 200.
Diplotaxis tenuifolia, 635.
Dipsacus fullonum, 635.
— sylvestris, 117, 635.
Dipterocarpus incanus, mentd., 423.
Dobinea vulgaris *Buch.-Ham.*, 169.
Dombeya excelsa, mentd., 452.
Doronicum altaicum *Pall.*, 191.
Draba alpina *Linn.*, 162.

Draba elata *Hook. fil. & Thoms.*, 162.
— involucrata *W. W. Sm.*, 162.
— lasiophylla *Royle*, 162.
Dracocephalum Hemsleyanum *Prain* *, 218.
— tanguticum *Maxim.*, 218.
Dracunculus vulgaris, 117, 635.
Drosera peltata *Smith* var. lunata *C. B. Clarke*, 185.
Dryopteris Filix-mas, 635.

Ecballium Elaterium, 635.
Echinops sphærocephalus, 635.
Echium vulgare, 117, 635.
Ectocarpus confervoides *Le Jol.*, 237, 241.
— fasciculatus *Harv.*, 237.
— granulosus *Ag.*, 235, 237, 249.
— Hinksiæ *Harv.*, 237.
— Sandrianus *Zan.*, 235, 237, 248.
— siliculosus *Kütz.*, 237.
— terminalis *Kütz.*, 237, 248.
— virescens, 249.
Edgeworthia Gardneri *Meissn.*, 220.
Egregia Menziesii, mentd., 248.
Elachista fucicola *Fries*, 237.
Elæagnus umbellata *Thunb.*, 220.
Elsholtzia strobilifera *Benth.*, 216.
Endoderma viride *Lagerh.*, 236.
Enkianthus deflexus *Schneid.*, 200.
Enteromorpha, 241, 253, 254.
— clathrata *J. Ag.*, 236, 255.
— compressa *Grev.*, 234, 236, 255.
— intestinalis *Link.*, 236, 255.
— Linza *J. Ag.*, 236.
— minima *Näg.*, 234, 236, 255.
Epilithon membranaceum *Heydr.*, 240.
Epilobium hirsutum, 635.
Equisetum, 333.
— arvense var. decumbens, 635.
— limosum, 117.
— palustre, 635.
Erigeron multiradiatus *Benth.*, 189.
— patentisquama *J. F. Jeffrey*, 189.
Eriophyton Wallichianum *Benth.*, 219.
Erodium cicutarium, 117, 635.
Erophila verna, 117.
Eruca sativa, 635.
Eryngium campestre, 635.
Erythrocladia, 250.
— irregularis *Rosenv.*, 238, 243, 250.
Erythrotrichia, mentd., 243.
— Bertholdii *Batt.*, 238.
— carnea *J. Ag.*, 238.
Eu-Festuca *Griseb.*, 61.
Eufrankenia, 345.
Euonymus porphyrea *Loes.*, mentd., 168.
— rongchuensis *Marquand & Shaw* *, 168.
— taliensis *Loes.*, 169.
— verrucosoides *Loes.*, 169.
Eupatorium cannabinum, 635
Euphorbia Cyparissias, 635.
— helioscopia, 117, 635.
— Lathyris, 117, 635.
— Peplus, 635.
— platyphyllos, 635.
Euphrasiæ, A Revision of the British (H. W. Pugsley), 467-544.
Euphrasia alpina *Lamk.*, mentd., 467, 475, 478, 479.
— americana *Wettst.*, mentd., 479.
— anglica *Pugs.*, 472, 486, 527.
— — var. gracilescens *Pugs.* *, 528.
— *arctica* Lange, 490, 492.
— *atropurpurea* Rostrup, 492.
— *atroviolacea* Druce & Lumb, 511, mentd., 483.
— Bicknellii *Wettst.*, mentd., 477.
— borealis *Towns.*, 469, 473, 474, 478, 479, 481, 482, 485, 515.
— — var. speciosa *Pugs.* *, 516.
— — var. zetlandica *Pugs.* *, 516.
— brevipila *Burnat & Gremli*, 469, 471-477, 479, 482, 485, 517.
— — f. gracilior *Pugs.* *, 518.
— — f. tenuiformis *Pugs.* *, 518.
— — var. notata *Pugs.* *, 519.
— — var. reayensis *Pugs.* *, 519.
— cærulea *Tausch*, 482 ; mentd., 470.
— cambrica *Pugs.*, 485, 501.
— campestris *Jord.*, 469, 481, 529, 539.
— — var. neglecta *Bucknall*, 538.
— canadensis *Towns.*, mentd., 469.
— *capitulata* Towns., mentd., 469.
— Christii *Favrat*, mentd., 477.
— confusa *Pugs.*, 470, 481, 485, 510.
— — f. albida, mentd., 483.
— — var. atroviolacea *Pugs.* *, 511.
— curta *Fries*, 467, 469, 470, 472, 476, 479, 480, 482, 485, 498.
— — f. littoralis *Neuman*, 499.
— — var. glabrescens *Wettst.*, 500.

Euphrasia curta *Fries* var. piccola *Pugs.**, 499.
— — var. rupestris *Pugs.**, 499.
— — × brevipila, 537.
— — × nemorosa, 536.
— disjuncta *Fern. & Wieg.*, mentd., 479.
— drosocalyx *Freyn*, mentd., 469, 475.
— fennica *Kihlman*, 482; mentd., 470.
— foulaensis *Towns.*, 469, 479, 481, 482, 484, 492.
— — f. condensata *Pugs.**, 493.
— — var. maritima *Pugs.**, 493.
— frigida *Pugs.**, 490.
— *gracilis* Fries, 467, 469, 471, 474, 475, 479, 482, 486.
— himalayica *Wettst.*, mentd., 478.
— hirtella *Jord.*, 470, 472, 475, 477, 478, 482, 486, 530.
— — var. polyadena *Pugs.**, 531.
— Jaeschkei *Wettst.*, 210.
— Kerneri *Wettst.*, 480, 513; mentd, 469, 474, 479.
— *Kerneri* Bucknall, 512.
— latifolia *Pursh*, 469, 471, 472, 475, 479, 480-482, 484, 490.
— — f. grandiflora *Wettst.*, 495.
— liburnica *Wettst.*, mentd., 479.
— Marshallii *Pugs.*, 485, 496.
— — var. pygmæa *Pugs.**, 497.
— Matsumuræ *Nadai*, mentd., 479.
— Maximowiczii *Wettst.*, mentd., 478.
— micrantha *Reichb.*, 484, 486.
— — f. simplex *Pugs.**, 487.
— — × anglica, 535.
— — × brevipila, 535.
— — × scotica, 534.
— minima *Jacq.*, 467, 470-475, 479, 481, 482, 489.
— *minima* Hiern, 510.
— *minima* Schleich, mentd., 467.
— mollis *Ledeb.*, mentd., 479.
— montana *Jord.*, 471, 477, 486, 524.
— multifolia *Wettst.*, mentd., 479.
— nemorosa *Löhr*, 505; mentd., 471, 472, 474-477, 479, 482, 485.
— — var. calcarea *Pugs.**, 506.
— — var. ciliata *Drabble*, 509; mentd., 470.
— — var. collina *Pugs.**, 506.
— — var. sabulicola *Pugs.**, 506.
— — var. tetraquetra *Bréb.*, 504, 508.
— — var. transiens *Pugs.**, 507.
Euphrasia nemorosa *Löhr* f. procumbens *Pugs.**, 507.
— — × anglica ?, 539.
— — × brevipila, 538.
— — × confusa, 537.
— — × Pseudo-Kerneri, 537.
— *nemorosa* H. Mart., mentd., 469.
— *nemorosa* Pers., mentd., 467.
— *nitidula* Reut., 505, 508.
— Oakesii *Wettst.*, 479.
— occidentalis *Wettst.*, 469, 485, 502.
— — var. calvescens *Pugs.**, 503.
— — var. minor *Pugs.**, 503.
— — var. præcox *Bucknall*, 503.
— officinalis *Linn.*, 117, 467, 469, 480, 635.
— paludosa *Towns.*, mentd., 469, 488.
— paucifolia *Wettst.*, mentd., 478.
— pectinata *Ten.*, mentd., 472, 475, 478.
— *polyadena* Gren. & Roux, 531.
— Portæ, mentd., 475.
— Pseudo-Kerneri *Pugs.*, 485, 512.
— — f. elongata *Pugs.**, 513.
— pulchella, mentd., 475.
— pumila *Kerner*, mentd., 477, 478.
— rivularis *Pugs.*, 486, 525.
— — f. compacta *Pugs.**, 526.
— Rostkoviana *Hayne*, mentd., 467, 469, 471, 472, 474, 475, 477-480, 482, 485, 522.
— — var. minuta *Beck*, 527.
— — var. obscura *Pugs.**, 522.
— rotundifolia *Pugs.*, 485, 494.
— salisburgensis *Funck*, mentd., 467, 469, 475, 477, 479, 486, 532.
— — var. hibernica *Pugs.**, 489.
— Schlagintweitii *Wettst.*, mentd., 478.
— scotica *Wettst.*, 469, 479, 482, 484, 488.
— — f. estriata *Pugs.**, 489.
— — var. purpurascens *Pugs.**, 489.
— — × brevipila, 536.
— stiriaca, mentd., 475.
— stricta *Host*, mentd., 467, 469, 470, 472, 474, 475, 477, 479, 480.
— suecica *Murb. & Wettst.*, mentd., 470, 474, 475, 477, 482.
— tatarica *Fischer*, mentd., 472, 477, 479.
— tenuis *Brenner*, mentd., 477.
— tricuspidata *Linn.*, mentd., 467, 479.
— variabilis *Druce & Lumb*, 511.
— versicolor *Kerner*, mentd., 478.
— *Vigursii* Davey, mentd., 470, 535.

Euphrasia *Vigursii* Davey var. *pallens* Bucknall, 536.
— Willkommii *Wettst.*, mentd., 479.
Euthora cristata *J. Ag.*, 239, 246.
Extravaginales *Hack.*, 67.

Fagus, mentd., 420.
— sylvatica, mentd., 417.
Ferraria undulata *Linn.*, 54.
Festuca in New Zealand (W. O. Howarth), 57-77.
— ampla *Hack.*, 65.
— arundinacea, 77.
— *bromoides* Linn., 57, 61.
— contracta *T. Kirke*, 57.
— Coxii *Hack.*, 57, 58, 77.
— dura *Host*, 57, 67.
— duriuscula *Linn.*, 57, 58, 60.
— erecta *D'Urv.*, 57, 58, 77.
— fallax *Thuill.*, 57.
— littoralis *Labill.*, 57, 76.
— — var. triticoides *Bentham*, 76.
— Matthewsii *Cheesem.*, 58.
— multinodis *Petrie & Hack.*, 58, 71.
— novæ-zelandiæ *Cockayne*, 58, 60.
— nubigense *Jungh.*, 65.
— ovina *Linn.*, 57-60.
— — subsp. brevifolia *Hack.*, 74.
— — subsp. eu-ovina *Hack.* var. duriuscula *Hack.*, 62.
— — — var. vulgaris *Hack.*, 61.
— — subsp. Matthewsii *Hack.*, 57, 58, 64.
— — — var. eu-Matthewsii *Howarth* *, 65.
— — — var. grandiflora *Howarth* *, 66.
— — subsp. novæ zelandiæ *Hack.*, 57, 58.
— — — var. eu-novæ-zelandiæ *Howarth* *, 63.
— — — var. grandiflora *Howarth* *, 64.
— — — var. pruinosa *Howarth* *, 64.
— Petriei *Howarth* *, 61, 68, 69, 70, 71.
— Porcii *Hack.*, 71.
— rubra *Linn.*, 57-60, 71.
— — subsp. *eu-rubra* Hack. var. *commutata* Gaud., 67.
— — — var. fallax *Hack.*, 67, 76.
— — — var. genuina *Hack.* subvar. arenaria *Hack.*, 67.
— — — — subvar. vulgaris *Hack.*, 67.
— — subsp. violacea *Hack.*, 76.
— — var. fallax *Hack.*, 57.
Festuca sciuroides *Roth.*, 61.
— scoparia *Hook.*, 57.
Ficus Carica, 635.
— foveolata *Wall.*, 221.
— sp. n. (?), 221.
Filago germanica, 635.
Filipendula hexapetala, 635.
Flustra, mentd., 234.
Fœniculum vulgare, 117, 635
Fomes fomentarius, 433.
— igniarius, 418.
Fragaria moschata, 635.
— vesca, 117.
— — var. sylvestris, 635.
Frankenia, A Revision of the Australian Species of (V. S. Summerhayes), 337-387.
— adpressa *Summerhayes* *, 342, 348, 350, 372.
— ambita *Ostenfeld*, 338, 339, 347, 349, 362.
— angustipetala *Summerhayes* *, 348, 352, 374.
— annua *Summerhayes* *, 339, 346, 349, 350, 379.
— brachyphylla *Summerhayes* *, 347, 350, 355, 356.
— bracteata *Turcz.*, 349, 351, 385.
— cinerea *A. DC.*, 347, 349, 356.
— *compacta* Ostenfeld, 382.
— conferta *Diels*, 338, 341, 342, 347, 349, 352, 353.
— confusa *Summerhayes* *, 348, 351, 363.
— connata *Sprague*, 341, 342, 348, 352, 375, 379.
— cordata *J. M. Black*, 339, 347, 349, 360; mentd., 362.
— cupularis *Summerhayes* *, 348, 350, 371.
— decurrens *Summerhayes* *, 347, 349, 356.
— densa *Summerhayes* *, 339, 348, 350, 373.
— desertorum *Summerhayes* *, 347, 351, 358.
— Drummondii *Benth.*, 337, 349, 351, 382, 383.
— eremophila *Summerhayes* *, 348, 352, 375.
— fecunda *Summerhayes* *, 348, 351, 367, 368.
— Fischeri *Hicken*, 345.
— flabellata *Sprague*, 348, 352, 372, 378.

Frankenia foliosa *J. M. Black*, 348, 350, 370.
— *fruticulosa* J. M. Black, 353.
— *fruticulosa* DC., 337, 366.
— *fruticulosa* Lehm., 365.
— *fruticulosa* Osborn, 336.
— Georgii *Diels*, 349, 351, 383, 384.
— glomerata *Turcz.*, 341, 349, 351, 384.
— gracilis *Summerhayes* *, 342, 349, 352, 380.
— grandifolia *Cham. & Schl.*, 346.
— hamata *Summerhayes* *, 342, 349, 351, 381, 382.
— interioris *Ostenfeld*, 339, 347, 351, 358, 359.
— — var. *conspicua* Ostenfeld, 376, 377.
— — var. parviflora *Summerhayes* *, 360.
— irregularis *Summerhayes* *, 347, 350, 358.
— Jamesii *Torr.*, 345.
— *lævis* F. Muell., 365, 369, 370, 377, 381, 382.
— *lævis* F. Muell. & Tate, 358, 360, 378, 381, 384.
— latior *Sprague & Summerhayes* *, 348, 352, 376.
— laxiflora *Summerhayes* *, 348, 351, 367.
— magnifica *Summerhayes* *, 348, 350, 368.
— *Maidenii* Ostenfeld, 356.
— muscosa *J. M. Black*, 348, 350, 370.
— Palmeri *Watson*, 338, 345; mentd., 347.
— parvula *Turcz.*, 342, 348, 350, 363.
— pauciflora *DC.*, 337, 338; mentd., 339, 342, 346, 348, 351, 363, 364.
— — var. fruticulosa *Summerhayes* *, 366.
— — var. Gunnii *Summerhayes* *, 366, 367.
— — var. longifolia *Summerhayes* *, 364; mentd., 366, 367.
— — var. *paleacea* Diels, 368.
— — var. *serpyllifolia* Benth., 363, 378.
— — var. *thymoides* Bailey, 378.
— — var. trichosticha *Summerhayes* *, 366.
— *pauciflora* Benth., 356, 360, 366, 374, 380.
— *pauciflora* Ewart & Davies, 361, 370.
— *pauciflora* Ewart, Kerr & Derrick, 379.
— *pauciflora* Graham, 365.
— *pauciflora* Hook. f., 360.
— *pauciflora* Maiden, 386.
— *pauciflora* S. Moore, 358.
Frankenia planifolia *Sprague & Summerhayes* *, 348, 352, 377.
— pseudo-flabellata *Summerhayes* *, 348, 350, 372.
— pulverulenta *Linn.*, 337, 338, 339, 350, 386.
— punctata *Turcz.*, 338, 347, 349, 356–358.
— scabra *Lindl.*, 348, 352, 374.
— serpyllifolia *Lindl.*, 338, 339, 342, 348, 352, 373, 376, 378.
— — var. *eremophila* J. M. Black, 373, 375.
— *serpyllifolia* J. M. Black, 373, 375, 377, 378, 381.
— *serpyllifolia* W. J. Bray, 363.
— *serpyllifolia* Osborn, 371.
— sessilis *Summerhayes* *, 347, 350, 353; mentd., 360.
— — var. major *Summerhayes* *, 354.
— setosa *W. V. Fitzgerald*, 349, 351, 384.
— speciosa *Summerhayes* *, 347, 349, 361.
— Stuartii *Summerhayes* *, 349, 351, 382.
— subteres *Summerhayes* *, 348, 351, 369.
— tetrapetala *Labill.*, 337, 339, 347, 350, 354.
— — var. *brachyphylla* Benth., 355.
— *tetrapetala* Diels & Pritzel, 353.
— *tetrapetala* F. Muell. & Tate, 360, 383.
— uncinata *Sprague & Summerhayes* *, 349, 351, 381, 382.
Freesia refracta *Klatt*, 30.
— Sparrmanni *N. E. Brown*, 30.
Fritillaria cirrhosa *D. Don*, 227.
— — var. brachyantha *Marquand & Shaw* *, 227.
Fuchs, Leonhart, the Herbal of (T. A. Sprague & E. Nelmes), 545–642; Index of Accepted Scientific Names of the Plants figured, 634–637; Index of certain Latin and German Names employed by Fuchs, 637.
Fucus ceranoides *Linn.*, 238, 254, 255.
— — var. linearis *Batt.*, 238, 247, 254, 255.
— serratus *Linn.*, 238, 252, 255.
— spiralis *Linn.*, 238, 252, 253, 255.
— vesiculosus *L.*, 238, 252, 253, 255.
Fumaria officinalis, 117, 635.
Fungi, Biology of Wood-rotting—common in Forest Areas (S. R. Bose), 417–438.
Furcellaria fastigiata *Lamour.*, 240.

Gagea lutea, 635.
Galaxia *Thunb.*, 18.
— fugacissima *Druce*, 18.
— graminea *Thunb.*, 18.
— *obtusa* Salisb., 18.
— ovata *Thunb.*, 18.
— versicolor *Salisb.*, 18.
Galeopsis Tetrahit *Linn.*, 218.
Galium Aparine, 635.
— Mollugo, 635.
— verum, 635.
Ganoderma lucidum, 433.
Gaultheria Forrestii *Diels*, 198.
— nummularioides *D. Don*, 198.
— sp. n. (?), 199.
— Veitchiana *Craib*, 198.
— Wardii *Marquand & Shaw* *, 198.
Geissorhiza Bellendeni *MacOwan*, 49.
— bicolor *N. E. Brown* *, 44.
— Brehmii *Eckl.*, mentd., 47.
— Dregei *Baker*, mentd., 47.
— excisa *Ker*, 47.
— graminifolia var. bicolor *Baker*, 47.
— hirta *Ker*, 47.
— humilis *Ker*, 47.
— — var. bicolor *Baker*, mentd., 50.
— — var. grandiflora *Baker*, 44.
— imbricata *Ker*, 47.
— pauciflora *Baker*, mentd., 49.
— purpureo-lutea *Baker*, mentd., 44.
— quinquangularis *Eckl.*, mentd., 47.
— recurvifolia *Klatt*, mentd., 47.
— Rocheana *Sweet*, mentd., 49.
— rochensis *Ker*, 49.
— secunda *Ker*, 50.
— — var. ramosa *Klatt*, 50.
— setacea *Baker*, 50.
— *setacea* Ker, mentd., 50.
— setifolia *Eckl.*, 50.
Gelidium corneum *Lamour.*, 238.
— pusillum *Le Jol.*, 238.
Genista germanica, 635.
— tinctoria, 635.
Gentiana, mentd., 152.
— algida *Pall.*, 204.
— — var. Romanzowii *Ledeb.*, mentd., 204.
— amœna *C. B. Clarke*, f. pallida *Marquand* *, 204.
— capitata *Buch.-Ham.*, 204.
— crassuloides *Bur. & Franch.*, 204.
Gentiana Cruciata, 117, 635.
— cyananthiflora *Franch.*, 204.
— lhassica *Burkill*, 204.
— lutea, 635.
— namlaensis *Marquand* *, 205.
— oreodoxa *H. Sm.*, 205.
— phyllocalyx *C. B. Clarke*, 205.
— prostrata *Haenke* var. bilobata *Marquand* *, 205.
— — var. crenulatotruncata *Marquand* *, 205.
— Pulmonaria *Turcz.*, 206.
— sikkimensis *C. B. Clarke*, 206.
— Trailliana *G. Forrest*, 206.
— tsarongensis *Balf. fil. & Forrest*, 206.
tubiflora *Wall.* var. namlaensis *Marquand* *, 206.
— Veitchiorum *Hemsl.*, 206.
— Waltoni *Burkill*, 207.
Geotropism of Pteridophyta.—IV. On Specificity in Graviperception (T. L. Prankerd), 317–336.
Geranium dissectum, 635.
— polyanthes *Edgew. & Hook. fil.*, 166.
— pratense, 635.
— pyrenaicum, 117.
— Robertianum, 635.
— rotundifolium, 635.
— sanguineum, 635.
Gesneraceæ, 214.
Geum intermedium × urbanum, 635.
— urbanum, 117, 635.
Gigartina mamillosa *J. Ag.*, 238, 254.
— stellata, 252.
Gladiolus, 19.
— alatus *Linn.*, 19; mentd., 21, 30, 31.
— *alatus* Thunb., 19.
— *alopecuroides* Thunb., 19.
— *anceps* Jacq., 20.
— *anceps* Linn. fil., 19.
— *anceps* Thunb., 19.
— angustus *Linn.*, mentd., 20, 33.
— *angustus* Thunb., 20.
— arcuatus *Klatt*, mentd., 31.
— *arenarius* Baker, 26.
— *bicolor* Baker, 33.
— *bicolor* Thunb., 20.
— *biflorus* Klatt, 48.
— *Bolusii* Baker, 23.
— — var. *Burchellii* L. Bolus, 23.
— *bracteatus* Thunb., 20.

Gladiolus brevifolius *Jacq.*, 20.
— *brevifolius* Thunb., 20.
— *bullatus* Thunb., 20.
— carneus *De la Roche*, 28.
— *communis* Thunb., 20.
— confusus *N. E. Brown* *, 31, 32.
— cordatus *Thunb.*, 20, 21.
— *crispus* Linn. fil., 21.
— *crispus* Thunb., 21.
— cuspidatus *Jacq.*, 33.
— debilis *Sims*, mentd., 48.
— *denticulatus* Lam., 19.
— elongatus *Thunb.*, 21.
— equitans *Thunb.*, 21.
— *exscapus* Thunb., 21.
— *Fabricii* Thunb., 22.
— *falcatus* Linn. fil., 22.
— *falcatus* Thunb., 22.
— fasciatus *Roem. & Schult*, mentd., 20.
— *fissifolius* Jacq., 53.
— *flexuosus* Linn. fil., 22.
— *flexuosus* Thunb., 22.
— formosus *Klatt.*, mentd., 33.
— fraternus *N. E. Brown* *, 26.
— *glumaceus* Thunb., 22.
— gracilis *Jacq.*, 21, 22, 24.
— *gracilis* Thunb., 22.
— *gramineus* Linn. fil., 22.
— *gramineus* Thunb., 22.
— grandis *Thunb.*, 22.
— hastatus *Thunb.*, 22, 23.
— hyalinus, mentd., 31.
— inflatus *Thunb.*, mentd., 20, 22.
— *involutus* Baker, 23.
— *involutus* De la Roche, 23.
— *ixioides* Thunb., 24.
— *junceus* Linn. fil., 24.
— *junceus* Thunb., 24, 46.
— laccatus *Thunb.*, 24.
— *lævis* Thunb., 24.
— *laxus* Thunb., 24.
— linearis *N. E. Brown* *, 48.
— *longiflorus* Linn. fil., 24, 25.
— *longiflorus* Thunb., 24, 25.
— maculatus *Sweet*, 32.
— *marginatus* Thunb., 25.
— *merianellus* Thunb., 25.
— *merianus* Thunb., 26.
— Milleri *Ker*, mentd., 33.
— *montanus* Linn. fil., 26, 27.
— — var. *nemorosus* Baker, 27.
Gladiolus *montanus* var. *ramosus* Baker, 27.
— *montanus* Thunb., 26, 32.
— *namaquensis* Ker, 21.
— nemorosus *N. E. Brown* *, 27.
— orchidiflorus *Andr.*, mentd., 33.
— ornatus *Klatt*, 23.
— Pappei *Baker*, 23.
— parviflorus *Jacq.*, 26, 32.
— permeabilis *De la Roche*, mentd., 21
— *plicatus* Linn., 18.
— *plicatus* Thunb., 28.
— pulchellus *Klatt*, 33.
— punctatus *Thunb.*, 28.
— puniceus *Lam.*, 24.
— ramosus *N. E. Brown* *, 27.
— recurvus *Linn.*, 28, 29.
— *recurvus* Thunb., 28, 29.
— *ringens* Thunb., 29.
— Rogersii *Baker*, 23.
— *secundus* Thunb., 30.
— *securiger* Ait., 50.
— segetum *Ker*, 20.
— *setifolius* Linn. fil., 30.
— *setifolius* Thunb., 30.
— *Sparrmanni* Thunb., 30.
— spathaceus *Pappe*, 20.
— *spathaceus* Linn. fil., 30.
— *spathaceus* Thunb., 30.
— speciosus *Thunb.*, 30.
— *spicatus* Thunb., 31.
— *spiralis* Thunb., 31.
— *striatus* Solander, 25.
— *subulatus* Vahl, 32.
— *Taubertianus* Schlechter, 23.
— tenellus *Jacq.*, 24, 31.
— *tenellus* Baker, 32.
— *tenellus* Thunb., 31.
— Thunbergii *Eckl.*, mentd., 23.
— trichonemifolius *Ker*, 31.
— trimaculatus *Lam.*, mentd., 20.
— *trinervis* Thunb., 22.
— *tristis* Thunb., 32.
— *triticeus* Thunb., 32.
— *tubiflorus* Linn. fil., 32.
— *tubiflorus* Thunb., 32.
— undulatus *Jacq.*, 33.
— *undulatus* Thunb., 33.
— unguiculatus *N. E. Brown* *, 27.
— *villosus*, Ker, 24.
— vinulus *Klatt*, 20.

Gladiolus viperatus *Ker*, mentd., 33.
— virescens *Thunb.*, 33.
— *Watsonius* Thunb., 33.
Glaucium flavum, 635.
Glechoma complanata *Turrill*, 217.
— hederacea, 117, 635.
Glycyrrhiza glabra, 117, 635.
Gomontia polyrhiza *Born. & Flah.*, 237, 255.
Good, R. D'O., Taxonomy and Geography of the Sino-Himalayan genus Cremanthodium *Benth.*, 259–316.
Gossypium herbaceum, 635.
Gracilaria confervoides *Grev.*, 239.
Griffithsia setacea *Ag.*, 240.
Groves, J., On Charophyta collected by Mr. T. B. Blow in Madagascar, 125–138.
Gueldenstaedtia himalaica *Baker*, 171.
Gymnadenia conopsea, 117, 635.

Haake Lamberti *Sweet*, mentd., 410.
Habenaria bifolia, 635.
— chrysea *W. W. Sm.*, 225.
Halenia elliptica *D. Don*, 208.
Hamiltonia suaveolens *Roxb.*, 189.
Hebea orchidiflora Eckl., 26.
— *ramosa* Eckl., 27.
— *tabularis* Eckl., 26.
Hedera Helix, 118, 635.
Helichrysum arenarium, 635.
Helixyra, 15.
— setifolia *N. E. Brown*, 39.
Helleborus fœtidus, 635.
— viridis, 118, 635.
Helminthostachys zeylanica, mentd., 646.
Hemiphragma heterophyllum, mentd., 175.
Heracleum Sphondylium, 118, 635.
Herbal of Leonhart Fuchs (T. A. Sprague & E. Nelmes), 545–642; of Otto Brunfels (T. A. Sprague), 79–124.
Heritiera minor, mentd., 428.
Herniaria glabra, 118.
Hesperantha cinnamomea *Ker*, 46.
— falcata *Ker*, 47, 49.
— graminifolia *Sweet*, mentd., 29, 47.
— pilosa *Ker*, 47, 49.
— *radiata* Ker, 28, 29.
— recurva *Ascherson & Graebner*, 28, 29.
Hesperantha setacea *Eckl.*, 29.
Hesperis matronalis var. hortensis subvar. albiflora, 635.
— — — subvar. purpurea, 635.
Heterosiphonia coccinea, 234.
— plumosa *Batt.*, 239.
Hexaglottis flexuosa *Sweet*, 52, 53.
— longifolia *Vent.*, 52, 53.
Hieracium Pilosella, 118, 635.
Hildenbrandtia sp., 240.
Holden, H. S., Wound Reactions of Ankyropteris corrugata, 643–655.
Homeria collina *Vent.*, 51.
— elegans *Sweet*, 38.
— miniata *Sweet*, mentd., 38, 51, 53.
— spicata *Sweet*, mentd., 52, 53.
— virgata *Sweet*, mentd., 52.
Homogyne, mentd., 261.
Hordeum distichon, 635.
— tetrastichum, 635.
— vulgare, 118.
Howarth, W. O., Festuca in New Zealand, 57–77.
Humulus Lupulus, 118, 635.
Hydrangea heteromalla *D. Don* var. parviflora *Marquand & Shaw* *, 183.
Hyella caespitosa *Born. & Flah.*, 236, 249, 255.
Hymenodictyon, 423.
— excelsum, 424.
Hyoscyamus niger, 118.
— — var. pallidus, 635.
Hypericum hirsutum, 635.
— montanum, 635.
— perforatum 118, 635.
Hyssopus officinalis, 118, 635.

Iberidella Andersoni *Hook. fil. & Thoms.*, 163.
— tibetica *Marquand & Shaw* *, 163.
Ilex aquifolium *Linn.* var. Caspia *Loes.*, 168.
— Gongonha, mentd., 455, 460, 464.
— Martiniana, mentd., 446, 455, 460, 464.
— paraguensis, mentd., 443, 453, 455, 460, 464.
— Pernyi *Franch.*, 168.
Impatiens arguta *Hook. fil. & Thoms.*, 166.
— Balsamina, 635.
— cristata *Wall.*, 166.

Impatiens fragicolor *Marquand & Shaw* *, 167.
— nyimana *Marquand & Shaw* *, 167.
— oxyanthera *Hook. fil.*, mentd., 167.
— sulcata *Wall.*, mentd., 167.
— Thomsoni *Hook. fil.*, mentd., 167.
— uliginosa *Franch.*, mentd., 167.
Incarvillea grandiflora *Bur. & Franch.*, 214.
Indigofera pseudotinctoria *Matsum.*, 170.
Intravaginales *Hack.*, 61.
Inula Helenium, 118, 635.
Iridaceæ of Thunberg's Herbarium (N. E. Brown), 15-55.
Iris, 15.
— *angusta* Thunb., 33.
— *bicolor* Lindl., 36.
— biflora, 33.
— *bituminosa* Thunb., 33.
— *ciliata* Thunb., 33.
— Clarkei *Baker*, 225.
— *compressa* Linn. fil., 34, 36, 42.
— *compressa* Thunb., 34.
— *crassifolia* Lodd., 36.
— *crispa* Thunb., 37.
— *edulis* Thunb., 37.
— fœtidissima, 635.
— germanica, 118, 635.
— goniocarpa *Baker*, 225.
— Gueldenstaedtii *Klatt*, 43.
— *minuta* Thunb., 38.
— *moræoides* Lodd., 36.
— *papilionacea* Thunb., 38.
— *pavonia* Thunb., 38.
— *plumaria* Thunb., 34, 38, 42.
— *polystachya* Thunb., 38.
— Pseudacorus, 118, 635.
— *ramosa* Thunb., 38.
— *ramosissima* Linn. fil., 38.
— *setacea* Thunb., 39.
— *setifolia* Linn. fil., 39.
— sp. n. (?), 225.
— *spathacea* Thunb., 39.
— *spathulata* Linn. fil., 39.
— *tricuspidata* Linn. fil., 39.
— *tricuspis* Thunb., 39.
— *tripetala* Linn. fil., 40.
— *tripetala* Thunb., 40.
— tristis *Thunb.*, mentd., 34, 40.
— *tristis* Linn. fil., 40, 42.
— *virginica* Thunb., 43.
Iris viscaria Thunb., 43.
Isactis plana *Thur.*, 236, 258.
Isatis tinctoria var. sativa, 635.
— — var. vulgaris, 635.
Isnardia palustris, 118.
Isthmoplea, mentd., 249.
Ixia, 43.
— *africana* Linn., 50.
— aristata *Thunb.*, 43.
— — var. *elegans* Baker, 43.
— *aristata* Ker, 44.
— *bicolor* Thunb., 44.
— *bulbifera* Thunb., 45.
— *bulbocodium* Thunb., 45.
— candida *Red.*, mentd., 44.
— capillaris *Linn. fil.*, 45, 49.
— *capillaris* Thunb., 45.
— *cinnamomea* Linn. fil., 46.
— *cinnamomea* Thunb., 46.
— *coccinea* Thunb., 46.
— columellaris *Ker*, 48.
— conica *Salisb.*, mentd., 43, 48, 49.
— *corymbosa* Thunb., 46.
— *crispa* Linn. fil., 46.
— *crispa* Thunb., 46.
— *crocata* Thunb., 46.
— *crocea* Thunb., 46.
— dubia *Vent.*, mentd., 49.
— elegans *N. E. Brown* *, 43.
— *elliptica* Thunb., 46.
— erecta *Thunb.*, 46.
— *erecta* Berg, mentd., 46.
— *excisa* Linn. fil., 47.
— *excisa* Thunb., 47.
— *falcata* Linn. fil., 47.
— *falcata* Thunb., 47.
— *fenestrata* Thunb., 47.
— *fistulosa* Andr., 29.
— *fruticosa* Linn. fil., 47, 55.
— *fruticosa* Thunb., 47.
— *fugacissima* Linn. fil., 18.
— *galaxia* Linn. fil., 18.
— *gladiata* Linn. fil., 53.
— *hirta* Thunb., 47.
— *humilis* Thunb., 47.
— incarnata *Jacq.*, 49.
— *lancea* Thunb., 48.
— leucantha *Jacq.*, mentd., 43, 44.
— *linearis* Linn. fil., 48.
— *linearis* Thunb., mentd., 45, 48.
— *longifolia* Jacq., 52.

Ixia longituba *N. E. Brown**, 44.
— maculata *Linn.*, 49.
— *maculata* Thunb., 48.
— micrandra *Baker*, 44.
— *minuta* Linn. fil., 49.
— *minuta* Thunb., 49.
— monadelpha *De la Roche*, 49.
— *monadelpha* Eckl., 46.
— *monanthos* Thunb., 49.
— paniculata *De la Roche*, 24.
— patens *Ait.*, mentd., 44, 46.
— patens *Gawl.*, mentd., 44.
— *pendula* Thunb., 49.
— *pentandra* Linn. fil., 49.
— *pentandra* Thunb., 49.
— *pilosa* Linn. fil., 49.
— *pilosa* Thunb., 49.
— *plicata* Linn. fil., 18.
— polystachya *Linn.*, mentd., 41, 46, 49.
— *polystachya* Thunb., 49.
— *radians* Thunb., 49.
— *radiata* Jacq., 29.
— *reflexa* Thunb., 49.
— *reticulata* Thunb., 49.
— retusa, mentd., 48.
— scariosa *Thunb.*, 49.
— *scillaris* Thunb., 50.
— *secunda* Thunb., 50.
— *setacea* Thunb., 50.
— speciosa *Andr.*, 46.
— *squalida* Thunb., 50.
— *sublutea* Lam., 46.
— tubulosa *Houttuyn*, mentd., 21.
— viridiflora *Lam.*, 50.
— *viridis* Thunb., 50.

Juglans regia, 635.
Juniperus communis, 118, 635.
— incurva *Buch.-Ham.*, 224.
— Sabina, 635.
— squamata, mentd., 453, 455, 457, 459, 462, 463.
— uvifera, mentd., 453, 455, 457, 459, 462, 463.

Kingdon-Wardia *Marquand**, 207.
— codonopsidoides *Marquand**, 207.
Kjellmannia, mentd., 249.
Knautia arvensis, 635.
Kylinia, 250.
— rosulata *Rosenv.*, mentd., 246.
— scapæ *Lyle**, 235, 238, 245, 250.

Lactuca Dubyæa C. B. Clarke, 194.
— sativa, 635.
— — var. crispa, 635.
— Scariola, 635.
— Souliei *Franch.*, 194.
— virosa, 118.
Lagenaria vulgaris, 118.
— — var. clavata, 635.
— — var. Gourda, 635.
— — var. turbinata, 635.
Lagotis glauca *J. Gaertn.*, 215.
Lambert, Aylmer Bourke and his 'Description of the Genus Pinus' (Renkema & Ardagh), 439-464; Letters to Sir James E. Smith extracted from Smithian Correspondence (S. Savage), 465; List of Publications, 464.
Laminaria, mentd., 234.
— digitata *Lamour.*, 237, 241, 242, 248, 252, 255.
— intermedia *Fosl.* var. longipes *Fosl.*, 237, 248, 250, 252, 254, 255.
— saccharina *Lamour.*, 234, 237, 242, 252,

Lamium album, 118, 635.
— maculatum, 118.
Lapeyrousia *aculeata* Sweet, 19.
— anceps *Baker*, 19.
— *anceps* Ker & Sweet, 20.
— azurea *Eckl.*, 46.
— compressa *Pourret*, 19.
— *cruenta* Baker, 24.
— *divaricata* Baker, 30.
— Fabricii *Ker*, 19, 22.
— falcata *Ker*, 22.
— fissifolia *Ker*, 20, 53.
— Jacquinii *N. E. Br.* *, 20.
— juncea *Pourr.*, 22, 24, 46, 54.
— laxa *N. E. Brown**, 24.
— *Pappei* Baker, 22.
— purpureolutea *Baker*, 46.
— *serrulata* Schlechter, 19.
— setifolia, *N. E. Brown**, 30.
Larix decidua, 635.
— Griffithii *Hook. fil. & Thoms.*, 225.

Larix occidentalis, mentd., 417.
Laserpitium latifolium, 635.
Lathyrus sativus, 635.
— sylvestris, 635.
— tuberosus, 635.
Laurencia pinnatifida *Lamour.*, 235, 239.
Lavandula officinalis, 635.
— Spica, 635.
— Stœchas, 635.
Leathesia difformis *Aresch.*, 237.
Leclercq, S., & Bellière, M., Psygmophyllum Gilkineti, sp. n., 1-14.
Lemna sp., 118.
Lens culinaris, 118, 635.
Lenzites malaccensis *Sacc. & Cub.*, 425, 426, 433, 434.
Leonhart Fuchs, The Herbal of (T. A. Sprague & E. Nelmes), 545-642.
Leontopodium nanum *Hand.-Mazt.*, 190.
Leonurus Cardiaca, 118, 635.
— Marrubiastrum, 118.
Lepidium campestre, 635.
— latifolium, 118, 635.
— ruderale, 118, 635.
— sativum, 118, 635.
Leptodermis scabrida *Hook. fil.*, 189.
Leptopterophyllum †, 396, 412, 413.
— Nathorsti *Thomas* * †, 393, mentd., 403, 413.
Leucojum vernum, 118, 635.
Leucosceptrum canum *Smith*, 219.
Levisticum officinale, 118, 635.
Leycesteria formosa *Wall.* var. stenosepala *Rehder*, 188.
Ligularia, 259-263, 313, 314.
— *arnicoides* DC., 287.
— — var. *glabrata* DC., 288.
— *cremanthodioides* Hand.-Mazz., 279.
— frigida *Sch. Bip.*, mentd., 294.
— melanocephala *Franch.*, 262.
— *nana* Decne, 300.
— *pleurocaulis* Hand.-Mazz., 290.
— — f. *uberrima* Hand.-Mazz., 290.
— reniformis *DC.*, 277.
— *retusa* DC., 278.
Ligustrum vulgare, 635.
Lilium, 227.
— candidum, 118, 635.
— croceum, 118, 635.
— hyacinthinum *E. H. Wilson*, 226.
Lilium Martagon, 118, 635.
— *nanum* Klotzsch, 227.
— taliense *Franch.*, 226.
— tigrinum *Ker-Gawl.*, 226.
— Wallichianum *Schultes fil.*, 227.
Linaria spuria, 635.
— vulgaris 118, 635.
- yunnanensis *W. W. Sm.*, 209.
Lindenbergia grandiflora *Benth.*, 210.
— Griffithii *Hook. fil.*, 210.
Lindera, mentd., 140, 144-146.
- cinnamomifolia, mentd., 146.
— — var. porifera, mentd., 146.
— megaphylla, mentd., 144, 145.
— Oldhami, mentd., 145.
— rubronervia, mentd., 144, 145.
— strychnifolia, mentd , 144.
Linum usitatissimum, 118, 635.
Listera ovata, 118, 635.
Lithoderma fatiscens *Aresch.*, 237, 242, 252.
Lithophyllum incrustans *Phil.*, 240.
— pustulatum *Fosl.*, 240.
— — var. Laminariæ *Fosl.*, 240.
Lithospermum arvense, 635.
-- officinale, 635.
Lithothamnion incrustans, 252, 254.
Litosiphon Laminaria *Harv.*, 237.
Litsea, mentd , 140, 145.
Lloydia Delavayi *Franch.*, 227.
— oxycarpa *Franch.*. 227.
— serotina *Sweet*, 228.
— — f. parva *Marquand & Shaw* *, 228.
— tibetica *Baker*, 228.
Lobaria pulmonaria, 635.
Lomatogonium deltoideum *Marquand* *, 207.
- oreocharis *Marquand* *, 207.
Lomentaria articulata *Lyngb.*, 239.
— clarellosa *Gaill*, 239.
— rosea *Thur.*, 235, 239.
Lonicera cyanocarpa *Franch.*, 187.
-- — var. porphyrantha *Marquand & Shaw* *, 187.
— hispida *Pall.*, 187.
— — var. chætocarpa *Batalin*, 187.
— — var. setosa *Hook. fil. & Thoms.*, 187.
— lanceolata *Wall.*, 187.
— litangensis *Batal.*, 187.
— Myrtillus *Hook. fil. & Thoms.*, 188,

Lonicera ovalis *Batalin* var. subcoriacea *Marquand & Shaw**, 188.
— Periclymenum, 635.
— setifera *Franch.*, 188.
— sp. 118.
— tomentella *Hook fil. & Thoms.*, 188.
— trichopoda *Franch.*, 188.
— Webbiana *Wall.*, 188.
Lotus corniculatus, 635.
Lupinus albus, 635.
Lychnis atsaensis *Marquand**, 163, 164.
— Coronaria, 118.
— namlaensis *Marquand**, 164.
— nigrescens *Edgew.*, mentd., 165.
— rubricalyx *Marquand**, 164.
— tristis *Bunge*, mentd., 164.
— Wardii *Marquand**, mentd., 163, 165.
Lycopsis arvensis, 635.
Lyle, L., Marine Algæ of some German Warships in Scapa Flow and of the Neighbouring Shores, 231-257.
Lyngbya majuscula *Harv.*, 236, 253.
Lysimachia Nummularia, 635.
— vulgaris, 635; mentd., 653.

Machilus Kurzii *King*, 220.
Maclura aurantiaca, mentd., 443, 453, 455, 460, 464.
Mæsa, sp. n., 201.
Magnolia rostrata *W. W. Sm.*, 158.
Mahonia *acanthifolia* G. Don. 160.
— napaulensis *DC.*, 160.
Maianthemum bifolium, 118.
Malus, sp. n. (?), 176.
spectabilis *Borkh.*, mentd., 176.
Malva Alcea, 118, 635.
— rotundifolia, 118, 635.
— sylvestris, 118, 635.
Mandragora officinarum, 635.
Mangifera indica, 419, 421, 422, 428, 429.
Marchantia polymorpha, 118, 635.
Marine Algæ of some German Warships in Scapa Flow and of the Neighbouring Shores (L. Lyle), 231-257.
Marquand, C. V. B., The Botanical Collection made by Captain F. Kingdon Ward in the Eastern Himalaya and Thibet in 1924-25, 149-230.
Marrubium vulgare, 118, 635.
Marsdenia lucida *Edgew.*, 202.
Marsdenia, sp. n. (?), 202.
Matricaria Chamomilla, 118, 635.
— inodora, 635.
Matthiola incana, 118, 635.
Meconopsis, mentd., 152.
Medicago lupulina, 118, 635.
Melampyrum arvense, 118.
Melasphærula graminea, *Ker*, 22.
Melilotus dentata, 635.
— officinalis, 118.
Melissa officinalis, 118, 635.
Melittis Melissophyllum, 635.
Melobesia Lejolisii, *Rosenv.*, 240.
Mentha aquatica, 635.
— arvensis, 635
— gentilis, 635.
— Pulegium, 118, 635.
— rotundifolia, 635.
— sativa, 635.
— sp., 118.
— sylvestris, 635.
— viridis, 635
Mercurialis annua, 635
— perennis, 635.
Meristostigma laxum A. Dietr., 24.
Mesembryanthemum, mentd., 15.
Mesozoic Cycadean Fronds, Further Observations on the Cuticle Structure of (H. Hamshaw Thomas), 389-416.
Metaclepsydropsis duplex, mentd., 653.
Meum athamanticum, 118, 635.
Micranthus alopecuroides *Eckl.*, 19.
— fistulosus *Eckl.*, 19.
plantagineus *Eckl.*, 19.
Microglossa albescens *C. B. Clarke*, 189.
Micromeria Piperella *DC.*, mentd., 216.
— Wardii *Marquand & Shaw**, 216.
Microula sikkimensis *Hemsl.*, 209.
— tibetica *Maxim.*, 209.
Mixtæ *Hack.*, 67.
Momordica Balsamina, 635.
Monostroma fuscum *Wittr.* var. Blythii *Batt.*, 234, 236, 250.
— Grevillei *Wittr.*, 236.
Montbretia striata Baker, 25.
Moræa, 15, 16, 50.
— *africana* Thunb., 50.
— angusta *Ker*, 33, 37.
— *aphylla* Linn. fil., 50.
— *aphylla* Thunb., 50.
— aristata *Aschers. & Graebn.*, 39.

Moræa *bermudiana* Thunb., 51.
— *bicolor* Spae, 36.
— bituminosa *Ker*, 33.
— *cærulea* Thunb., 51.
— *catenulata* Lindl., 36.
— *chinensis* Thunb., 51.
— ciliata *Ker*, 33, 38.
— *collina* Thunb., 51.
— crispa *Ker*, 37, 42.
— *crispa* Thunb., 51.
— *dichotoma* Thunb., 52.
— edulis *Ker*, 52; mentd., 54.
— *edulis* Linn. fil., 37, 38.
— *filiformis* Linn. fil., 52.
— *filiformis* Thunb., 52.
— *flexuosa* Linn. fil., 16, 52.
— *flexuosa* Thunb., 52.
— gigantea *Klatt*, 51.
— *gladiata* Murray, 53.
— *gladiata* Thunb., 53.
— *glaucopis* Drap., 39.
— grandiflora *Eckl.*, 51.
— *iridioides* Linn., 34, 36.
— — var. *catenulata* Baker, 36.
— — var. *prolongata* Baker, 37.
— *iridioides* Linn. fil., 42.
— *iridioides* Thunb., 53.
— *iriopetala* var. *juncea* Linn. fil., 37, 42.
— — var. *vegeta*, Linn. fil., 38, 42.
— juncea *Linn.*, 40-42.
— longifolia *Sweet*, mentd., 38.
— *lugens* Linn. fil., 53.
— *melaleuca* Thunb., 53.
— minuta *Ker*, 38.
— *mira* Klatt, 38, 42.
— monophylla *Baker*, 40.
— *ovata* Thunb., 53.
— papilionacea *Ker*, 38.
— pavonia *Ker*, 38.
— — var. lutea *Baker*, 38.
— plumaria *Ker*, 38, 42.
— polyanthos *Linn. fil.*, 53.
— *polyanthos* Thunb., 40, 53.
— polystachya *Ker*, 38.
— *pusilla* Thunb., 54.
— *ramosa* Ker, 38.
— ramosissima *Druce*, 38.
— *setacea* Ker, 39.
— *setifolia* Druce, 39.
— spathacea *Ker*, mentd., 39.
— *spathacea* Thunb., 54.
Moræa spathulata *Klatt*, 39.
— *spiralis* Linn. fil., 54.
— *spiralis* Thunb., 54.
— tricuspis *Ker*, 39.
— tripetala *Ker*, 40.
— *tristis* Ker, 42.
— umbellata *Thunb.*, 54.
— undulata *Ker*, 51.
— *undulata* Thunb., 54.
— unguiculata *Gawl.*, mentd., 38.
— *vegeta* Jacq., mentd., 42.
— *vegeta* Linn., 34, 36; mentd., 38, 42, 53.
— *vegeta* Murray, 42.
— villosa *Ker*, 39.
— viscaria *Ker*, 43.
— *xerospatha* MacOwan, 39.
Morina betonicoides *Benth.*, 189.
— longifolia *Wall.*, mentd., 189.
— sp. n., 189.
Morus nigra, 635.
Muscari botryoides, 635.
— comosum, 635.
Myosotis palustris, 118.
Myricaria germanica, 635.
— prostrata *Benth. & Hook. fil.*, mentd., 166.
— Wardii *Marquand* *, 166.
Myrionema vulgare *Rosenv.*, 237.
Myriophyllum, mentd., 645.
Myriotricha filiformis *Harv.*, 237.
Myrsine semiserrata *Wall.* var. subspinosa *C. B. Clarke*, 201.
Myrtaceæ, on the Cuticles of some Recent and Fossil (Bandulska), 657-671.

Narcissus Pseudo-Narcissus, 118.
Nasturtium officinale, 636.
Nelmes, E., *see* Sprague, T. A.
Nepenthes ampullaria, mentd., 444, 455, 460, 464.
— Rafflesiana, mentd., 444, 455, 460, 464.
Nepeta Cataria, 118, 636.
— cœrulescens *Maxim.*, 217.
— *Hemsleyana* Oliver, 218.
— Thomsoni *Benth.*, 217.
Nerium Oleander, 636.
Nigella arvensis, 636.
— damascena, 636.
— sativa, 636.
Nilssonia †, 401, 402, 411, 413.
— mediana †, 409.

Nitella *Agardh*, 127.
— acuminata *Braun*, 126, 127.
— Blowiana *J. Groves* *, 133, 134.
— dualis *Nordst.*, mentd., 134.
— furcata *Agardh*, 126, 132.
— graciliformis *J. Groves* *, 128.
— gracilis, 126, 129.
— inæqualis *J. Groves* *, 127.
— *leptoclada* Braun, 130, 131.
— leptodactyla *J. Groves* var. megaspora *J. Groves* *, 132.
— leptosoma *Nordst.*, mentd., 132.
— mucronata *Miquel*, 126.
— — var. mobilis *J. Groves* *, 127.
— oligospira, mentd., 129.
— *polyglochin* Braun, 132.
— *Roxburghii* Braun. 132.
— sphærocephala *J. Groves* *, 130.
— tenuissima *Kutz.*, 126.
— — var. callista *J. Groves* *, 129
— translucens, mentd., 131.
— vermiculata *J. Groves* *, 131.
Nitophyllum laceratum *Grev.* f. reptans *Lyle*, 239, 247.
— *reptans* Zan., 247.
Nivenia fruticosa *Baker*, 47, 55.
Noegerathia *Lindley & Hutton*, mentd., 9.
Nomocharis nana *E. H. Wilson*, 227.
Nuphar luteum, 118, 636.
Nymphæa alba, 118, 636.

Oceania, 338, 339.
Ocimum Basilicum var. majus, 118, 636.
— — var. minimum, 635.
— — var. vulgare, 636.
Odonthalia dentata *Lyngb.*, 231, 239, 242, 254.
Ononis spinosa, 636.
Onopordon Acanthium, 118, 636.
Onosma Hookeri *C. B. Clarke*, 209
— Waddellii *Duthie*, 209.
Ophioglossum vulgatum, 636.
Ophrys apifera, 636.
— fuciflora, 118.
Orchis maculata, 636.
— mascula, 636.
— militaris, 118, 636.
— Morio, 118, 636.
— purpurea, 118.
Orchis ustulata, 636.
Oreocharis (?), 214.
Oreogenia Munroi *J. M. Johnston*, 209.
Origanum Majorana, 636.
— vulgare, 118, 636.
Oscillatoria margaritifera *Kütz.*, 236, 252.
Osmunda, 335.
— cinnamomea *Linn.*, 323, 325, 327; mentd., 329-333.
— gracilis, 320, 322; mentd., 323, 325, 327, 329-332.
— regalis, 317, 320, 322; mentd., 323, 325, 329-332.
— — var. japonica *C. Chr.*, 325, 327; mentd., 329, 331, 332.
— — var. undulata *Hort.*, 327, 329, 331, 332.
Ostreobium Quekettii *Born. & Flah.*, 237, 242, 249, 250, 255.
Otozamites †, 399-402, 411, 412.
— Feistmanteli *Zigno* †, 398.
— graphicus †. 399.
— Mandelslohi *Schimp.* †. 400.
— *obtusus* Krasser †, 400, 401.
Ribeiroanus *Heer* †, 398.
Orcula anceps Spreng., 19.
Oxalis Acetosella, 118, 636.
Oxyria digyna *Hill*, 220.
Oxytropis lapponica *Gaud.* var. xanthantha *Baker*, 172.
— yunnanensis *Franch.*, 172.

Pæonia Delavayi *Franch.* var. lutea *Finet & Gagnepain*, 158.
— *lutea* Delavay, 158.
— officinalis, 118.
— peregrina, 636.
Palæopitys Milleri, mentd., 12.
Panax pseudo-ginseng, Wall., 186.
Panicum miliaceum, 118, 636.
Papaver Rhœas, 118, 636.
— somniferum, 118, 636.
Paracaryum glochidiatum *C. B. Clarke*, 209.
Paraquilegia microphylla *Drummond & Hutchinson*, 156.
Parietaria officinalis, 118, 636.
Paris quadrifolia, 636.
Pastinaca sativa var. edulis, 636.

Pastinaca sativa var. sylvestris, 636.
Pauridia *hypoxidoides* Harv., 49.
— minuta *Dur. & Schinz*, 49.
Pedicularis, mentd., 152.
— aphyllocaulis *Hand.-Mzt*, 212.
— aschistorrhyncha *Marquand & Shaw* *, 210.
— bella *Hook. fil.* var. holophylla *Marquand & Shaw* *, 211.
— — — f. rosea *Marquand & Shaw* *, 211.
— cephalantha *Franch.*, 211.
— cheilanthifolia *Schrenk*, 211.
— cryptantha *Marquand & Shaw* *, 211.
— densispica *Franch.*, 212.
— Elwesii *Hook. fil.*, 212.
— gracilis *Wall.*, 212.
— ingens *Maxim.*, 212.
— insignis *Bonati*, mentd., 210.
— integrifolia *Hook. fil.*, 212.
— longiflora *Rudolph*, 212.
— macrantha *Klotzsch*, mentd., 210.
— mollis *Wall.*, 212.
— mychophila *Marquand & Shaw* *, 212.
— Oederi *Vahl*, 211, 213.
— pectinata *Wall.*, 211, 213.
— rhinanthoides *Schrenk*, 213.
— Roylei *Maxim.*, 213.
— — var. cinerascens *Marquand & Shaw* *, 213.
— Scullyana *Prain*, mentd., 210.
— siphonantha *D. Don*, 214.
— szechuanica *Maxim.*, 214.
— trichoglossa *Hook. fil.*, 214.
Pelvetia, 252, 253.
— canaliculata *Dcne. & Thur.*, 238.
Percursaria percursa *Rosenv.*, 236.
Petasites hybridus, 636.
Petrocelis cruenta *J. Ag.*, 240, 252, 254.
— Hennedyi *Batt.*, 240.
Petroselinum hortense, 636.
Peucedanum Cervaria, 636.
— officinale, 636.
— Ostruthium, 118, 636.
Peyrousia aculeata Sweet, 19.
Peyssonelia Dubyi *Crn.*, 240.
Phaseolus vulgaris, 636.
Phlogacanthus thyrsiflorus *Nees*, 215.
Phlomis bracteosa *Royle*, 218.
— tibetica *Marquand & Shaw* *, 218.
— — var. Wardii *Marquand & Shaw* *, 219.
Phyllitis Scolopendrium, 118, 636.
Phyllocladus trichomanoides, mentd., 458.
Phyllophora Brodiæi *J. Ag.*, 239.
— Traillii *Holm. & Batt.*, 235, 239, 247.
Physalis Alkekengi, 118, 636.
Picea, 224.
Pieris formosa *D. Don*, 199.
— ovalifolia *D. Don*, 199.
— sp. n. (?), 200.
Pimpinella Anisum, 118, 636.
— major, 636.
— saxifraga, 118.
— tenera *Benth.*, 185.
Pinguicula alpina *Linn.*, 214.
Pinus, 224.
— Abies, mentd., 452, 454, 456, 458, 461.
— alba, mentd., 452, 454, 456, 458, 461.
— Armandi *Franch.*, 224.
— balsamea, mentd., 452, 454, 456, 458, 461.
— Banksiana, mentd., 452, 453, 455, 456, 458, 461.
— bracteata, mentd., 455, 460, 462.
— Brutia, mentd., 455, 460, 462.
— canadensis, mentd., 452, 454, 457, 459, 461.
— canariensis, mentd., 455, 456, 460, 461.
— Cedrus, mentd., 452, 454, 457, 459, 462.
— Cembra, mentd., 452, 454, 456, 458, 461.
— Coulteri, mentd., 447, 449, 455, 460, 462.
— Dammara, mentd., 443, 452.
— Deodora, mentd., 453, 454, 457, 459, 462, 463.
— Douglasii, mentd., 447, 455, 457, 460, 461.
— dumosa, mentd., 447, 452, 454, 457, 459, 461, 463.
— excelsa *Wall. ex Lamb.*, 224; mentd., 445, 452, 454, 456, 458, 461, 463.
— Fraseri, mentd., 455, 456, 460, 461.
— Gerardiana, mentd., 455, 457, 460, 462.
— grandis, mentd., 456, 457, 460, 462.
— Grenvillea, mentd., 449.
— halepensis, mentd., 452, 453, 456, 458, 461.
— inops, mentd., 452, 454, 456, 458, 461.
— Lambertiana *Douglas*, mentd., 440, 455, 456, 460, 461.
— lanceolata, mentd., 443, 452, 454, 459, 462.

Pinus Laricio, mentd., 443, 453, 456, 458, 461, 463.
— Larix, mentd., 452, 454, 457, 459, 462.
— leiophylla, mentd., 455, 456, 460, 461.
— Lemoniana, mentd., 449.
— longifolia, mentd., 443, 452, 454, 456, 458, 461.
— maritima, mentd , 443, 449, 452, 453, 456, 458, 461, 463.
— Massoniana, mentd., 452, 453, 456, 458, 461.
— Menziesii, mentd., 455, 457, 460, 462.
— microcarpa, mentd., 452, 454, 457, 459, 462.
— Montezumæ, mentd., 455, 456, 460, 461.
— monticola, mentd., 455, 457, 460, 462.
— muricata, mentd., 455, 460, 462.
— nigra, mentd., 450, 452, 454, 456, 458, 461.
— nobilis, mentd., 455, 457, 460, 462.
— occidentalis, mentd., 452, 454, 456, 458, 461.
— orientalis, mentd., 452, 454, 456, 458, 461, 465.
— Pallasiana, mentd., 452, 453, 456, 458, 461, 463.
— palustris, mentd., 452, 454, 456, 458, 461.
— patula, mentd., 455, 456, 460, 461.
— pendula, mentd., 452, 454, 457, 459, 462.
— Picea, mentd., 452, 454, 456, 458, 461.
— Pinaster, mentd., 452, 454, 456, 458, 461.
— Pindrow, mentd., 462.
— Pinea, mentd., 452, 454, 456, 458, 461.
— Pumilio, mentd., 451, 453, 456, 458, 461.
— pungens, mentd., 445, 448, 455, 456, 460, 461.
— radiata, mentd., 455, 460, 462.
— religiosa, mentd., 456, 460, 461.
— resinosa, mentd., 452, 454, 456, 458, 461.
— rigida, mentd., 452, 454, 456, 458, 461.
— rubra, mentd., 452, 454, 456, 458, 461.
— Sabiniana, mentd., 455, 457, 460, 462.
— serotina, mentd., 447, 455, 456, 460, 461.
— sinensis *Lamb.*, 224; mentd., 450, 455, 456, 460, 461.
— Smithiana, mentd., 455, 460, 462.
Pinus spectabilis, mentd., 444, 445, 452, 454, 459, 461, 463.
— Strobus, mentd., 452, 454, 456, 458, 461.
— sylvestris, mentd., 451, 453, 456, 458 461, 465.
— Tæda, mentd., 445, 452, 454, 456, 458, 461.
— taxifolia, mentd., 450, 452, 454, 457, 459, 461.
— Teocote, mentd., 455, 456, 460, 461.
— tuberculata, mentd., 449, 455, 460, 462.
— variabilis, mentd., 452, 454, 456, 458, 461.
— Webbiana, mentd., 450, 457, 461.
Piptanthus bombycinus *Marquand**, 169
— tomentosus *Franch.*, 169.
Pisum sativum, 118, 636.
Plantago Coronopus, 636.
— lanceolata, 118, 636.
— major, 118, 636.
— media, 118, 636.
— Psyllium, 636.
Plectranthus Bulleyanus *Diels*, 216.
— oresbius *W. W. Sm.*, 216.
— Wardii *Marquand & Shaw**, 216.
Pleonosporium Borreri *Näg.*, 240.
Pleurogyne deltoidea Burkill, 207.
— *oreocharis* Diels, 207.
Pleurospermum amabile *Craib & W. W. Sm.*, 185.
— Hookeri *C. B. Clarke*, 185.
Plocamium coccineum *Lyngb.*, 239.
Plumaria elegans *Schm.*, 240, 252.
Poa cæspitosa, 60.
— litorosa *Cheesem.*, 57.
Podocarpus ferruginea (?), mentd., 458.
— glomerata, mentd., 453, 455, 457 459, 462, 463.
— macrophylla, mentd., 453, 455, 457, 459, 462, 463.
— neriifolia, mentd., 453, 455, 457, 459, 462, 463.
— oleifolia, mentd., 453, 455, 457, 459, 462, 463.
— pungens, mentd., 453, 455, 457, 459, 462, 463.
— saligna, mentd., 453, 455, 457, 459, 462, 463.
— Totara (?), mentd., 458.
Pogostemon elsholtzioides *Benth.*, 216.

Polygonatum, 226.
— multiflorum, 118, 636.
— verticillatum, 636.
Polygonum alpinum *All.*, 219.
— amplexicaule *D. Don*, 219.
— aviculare, 636.
— Bistorta, 118, 636.
— filicaule *Wall.*, 219.
— Forrestii *Diels*, 219.
— Hydropiper, 636.
— lapathifolium, 118, 636.
— Persicaria, 118.
— sibiricum *Laxm.*, 219.
Polypodium vulgare, 118, 636.
Polyporus adustus *Fr.*, 420, 422; mentd., 424, 434, 435.
— calcuttensis *Bose*, 426–428.
— ostreiformis *Berk.*, 432.
Polysiphonia, 252.
— atro-rubescens *Grev.*, 239.
— Brodiæi *Grev.*, 239.
— fastigiata *Grev.*, 239, 252.
— macrocarpa *Harv.*, 239.
— nigrescens *Grev.*, 235, 239.
— urceolata *Grev.*, 239, 241.
— violacea *Grev.*, 239.
Polystichum aculeatum, 118.
Polystictus hirsutus *Fr.*, 430, 431.
— sanguineus *Linn.*, 423, 434.
— velutinus *Fr.*, 431, 434, 435.
Polytrichum commune, 118, 636.
Populus alba *Linn.*, 223.
— ciliata *Wall.* var. aurea *Marquand & Shaw* *, 223.
Poria, mentd., 419, 426, 429, 435.
Porphyra, mentd., 234, 243, 253.
— miniata *Linn.* var. abyssicola *Rosenv.*, 238, 253.
— umbilicalis *Kütz.*, 234, 238.
— — var. laciniata *J. Ag.*, 238, 253.
Porphyriopsis, mentd., 243.
— coccinea *Rosenv.*, 235, 238.
Portulaca oleracea var. sativa, 636.
— — var. sylvestris, 636.
Potamogeton natans, 636.
Potentilla alba, 636.
— ambigua *Cambess.*, 174.
— Anserina, 118, 636.
— erecta, 118, 636.
— eriocarpa *Wall.* var. dissecta *Marquand & Shaw* *, 174
Potentilla euxantha *W. E. Evans* *, 174.
— fruticosa *Linn.*, 171, 174.
— — var. grandiflora *Marquand* *, 175.
— microphylla *D. Don*, 175.
— monanthes *Lindl.* var. sibthorpioides *Hook. fil.*, 175.
— recta var. obscura, 118.
— reptans, 118, 636.
— sp., 118, 636.
Poterium Sanguisorba, 636.
Prankerd, T. L., Geotropism of Pteridophyta.—IV. On Specificity in Graviperception, 317–336.
Prenanthes brunoniana *Wall.*, 194.
Primula, mentd., 152.
— elatior, 118, 636.
— veris, 118, 636.
Prinsepia utilis *Royle*, 174.
Protococcus marina *Kütz.*, 234, 236.
Prunella vulgaris, 636.
Prunus avium, 636.
— cinerascens *Franch.*, 173.
— domestica, 636.
— fruticosa *Pallas*, 173.
— latidentata *Koehne*, 173.
— Persica, 636.
— rufa *Steud.*, 174.
— spinosa, 118, 636.
Psilotum triquetrum, mentd., 652.
Psygmophyllum *Schimper* †, mentd., 9.
— flabellatum *Lindl. & Hutt.* †, 10, 11.
— Gilkineti *Leclercq & Bellière* *†, 1–14.
— Kidstoni *Sew.* †, 10–12.
— Kolderupi *Nath.* †, 10, 11.
— majus *Arber* †, 10, 11.
— obtusa *Lesq.* †, 10, 11.
Pteridium aquilinum, 636.
Pteridophyta, Geotropism of.—IV. On Specificity in Graviperception (T. L. Prankerd), 317–336.
Pterophyllum †, 394–396, 401–405, 411–413.
— æquale †, 402, 405, 408.
— Andræanum *Schimp.* †, 402–405, 412.
— Braunianum *Goepp.* †, 403.
— *brevipenne* Kurr. †, 406, 409.
— concinnum *Heer* †, 410.
— Dunkerianum *Goepp.* †, 403.
— *Dunkerianum* Andrae †, 403.
— Fayoli *Renault* †, 402, 410.

Pterophyllum filicoides *Thomas* * †, 406, 409–411.
— *filicoides* Sch. †, 402, 405.
— Grand'Euryi *Sap. & Mar.* †, 402, 409, 410.
— intermedium *Antevs* †, 412.
— *Jaegeri* Brongn. †, 406–409.
— Kochi *Harris* †, 402, 412, 413.
— *longifolium* Brongn. †, 402, 404–407, 409.
— Nathorsti *Schenk* †, mentd., 394.
— *Nathorsti* Seward †, 393.
— Oeynhausenianum *Goepp.* †, 403, 405, 411.
— pecten *Phill.* †, 390–392; mentd., 393.
— *rigidum* Andrae †, 392.
— Schenki *Zeiller* †, 402.
— subæquale *Hartz* †, 402.
Pterosiphonia parasitica *Falk.* var. repens *J. Ag.*, 235, 239, 247.
Ptilophyllum †, 395–397, 411–413.
— boreale *Sew.* †, 396, 413.
— imbricatum *Krass.* †, 390, 393.
— pecten †, 398.
— rigidum *Krass.* †, 392.
Ptilota plumosa *Ag.*, 235, 240, 242.
Ptilothamnion, mentd., 247.
Ptilozamites †, 411.
Ptychogaster, 426, 427.
Pugsley, H. W., Revision of the British Euphrasiæ, 467–544.
Pulicaria dysenterica, 636.
Punctaria plantaginea *Grev.*, 237.
Pylaiella, 249.
— litoralis *Kjellm.*, 235, 237.
— — var. longifructus *Batt.*, 234, 237.
Pyrola Forrestiana *H. Andres*, 200.
— minor *Linn.*, 200.
— rotundifolia, 118, 636.
Pyrus Malus, 118.

Quercus grandifolia, mentd., 443, 453, 455, 460, 463.
— incana *Roxb.*, 221.
— Robur, 636.
— semiserrata *Roxb.*, 221.

Ralfsia pusilla *Batt.*, 237, 248.
Ranunculus acris var. flore pleno, 118, 636.
Ranunculus arvensis, 636.
— auricomus, 636.
— bulbosus, 118, 636.
— Ficaria, 118, 636.
— nemorosus, 118.
— oreionannos *Marquand & Shaw* *, 155.
— repens var. suberectus, 636.
— sceleratus, 636.
— tricuspis *Maxim.*, mentd., 155.
Raphanus sativus, 118, 636.
Renkema, H. W., & Ardagh, J., Aylmer Bourke Lambert and his 'Description of the Genus Pinus,' 430–464.
Revision of the British Euphrasiæ (H. W. Pugsley), 467–544.
Rhamnus leptophyllus *C. H. Schneider*, 169.
Rheum tibeticum *Maxim.*, 219.
Rhizoclonium, 253.
— arenosum *Kütz.*, 236.
— riparium *Harv.*, 236.
Rhodochorton floridulum *Näg.*, 240.
— Rothii *Näg.*, 240, 252, 254.
Rhododendron, mentd., 152.
— lacteum, mentd., 171.
Rhodomela lycopodioides *Ag.*, 239.
— subfusca *Ag.*, 239.
Rhodomyrtus *Reichburg*, 657.
— macrocarpa, 657.
— psidioides, 657, 658.
— sinuata *Bandulska* * †, 659.
— surigavensis, 657, 658.
— tomentosa, 657, 658.
— trineura, 658.
Rhodophyllis appendiculata *J. Ag.*, 239.
— bifida *Kütz.*, 239, 242.
Rhodymenia palmata *Grev.*, 242, 255.
— — f. typica *Grev.*, 239.
— — var. marginifera *Harv.*, 239, 255.
— — var. sarniensis *Grev.*, 239, 255.
Ribes, 184.
— alpestre *Wall.*, 184.
— Griffithii *Hook. fil. & Thoms.*, 184.
— luridum *Hook. fil. & Thoms.*, 184.
— rubrum, 636.
— Uva-crispa, 636.
Ricinus communis, 118, 636.
Rivularia atra *Roth.*, 236, 253.
— nitida *Ag.*, 236.
— plicata, 253.
Romulea bulbocodioides *Baker*, 49.

Romulea bulbocodioides var. elongata *Baker*, 49.
— rosea *Eckl.*, 45.
— similis *Eckl.*, 45.
— sublutea *Baker*, 46.
Rorippa sylvestris, 636.
Rosa, 176.
— canina, 636.
— gallica, 636.
— Moyesii *Hemsl. & Wils.*, 175.
— provincialis, 118.
— sericea *Lindl.*, 175.
— Sweginzowii *Koehne* var. inermis *Marquand & Shaw* *, 175.
Rosmarinus officinalis, 118, 636.
Rubia tinctorum, 636.
Rubus calophyllus *C. B. Clarke*, 174.
— fruticosus, 118, 636.
Rumex Acetosa, 118, 636.
— alpinus, 636.
— obtusifolius, 118, 636.
— Patientia, 118.
Ruscus Hypoglossum, 118, 636.
Ruta graveolens, 118, 636.

Saccorhiza bulbosa *De La Pyl*, 237, 241, 242, 245.
Salix, 222.
— amygdalina *Linn.* var. nipponica *Schneid.*, 151, 221, 222.
— annulifera *Marquand & Shaw* *, 222.
— — var. macriula *Marquand & Shaw* *, 222.
— argyrophegga *Schneid.*, mentd., 222.
— babylonica *Linn.*, mentd., 151, 221, 222, 449.
— calyculata *Hook. fil.*, 223.
— flabellaris *Anderss.*, 223.
— opaca *Anderss.*, 223.
— opsimantha *Schneid.*, mentd., 222.
— purpurea, 636.
— repens var. rosmarinifolia, 636.
— sikkimensis *Anderss.*, 223.
— vitellina, 636.
Salvia hians *Royle*, 217.
— officinalis, 118, 636.
— — var. aurita, 636.
— pratensis, 118, 636.
— Przewalskii *Maxim.*, 217.
— Sclarea, 636.
Salvia tricuspis *Franch.*, 217.
Sambucus Ebulus, 118, 636.
— nigra, 118, 636.
Sanguisorba officinalis, 636.
Sanicula europæa, 118, 636.
Santolina Chamæcyparissus, 636.
Saponaria officinalis, 636.
Sarcococca Hookeriana *Baill.*, 220.
Sarothamnus scoparius, 636.
Satureja Acinos, 636.
— hortensis, 636.
Saussurea Atkinsoni *C. B. Clarke*, 192.
— gnaphalodes *Ostenf.*, 193.
— gossipiphora *D. Don*, 192.
— graminifolia *Wall.*, 192.
— obvallata *Wall.*, 192.
— Rohmooana *Marquand & Shaw* *, 192.
— tridactyla *Schultz*, 193.
Savage, S., Extracts from Smithian Correspondence on Lambert's 'Description of the Genus Pinus,' 465.
Saxifraga, mentd., 152.
— atrata *Engl.*, 176.
— bergenioides *Marquand* *, 176.
— brachypoda *Don*, mentd., 179.
— — var. fimbriata *Engl. & Irmsch.*, 179.
— Caveana *W. W. Sm.*, 177.
— Diapensia *H. Sm.*, 177.
— flagellaris *Willd.*, 177.
— — var. euflagellaris *Engl. & Irmsch.*, mentd., 177.
— Gageana *W. W. Sm.*, 177.
— granulata, 118, 636.
— gyalana *Marquand & Shaw* *, 177.
— heterotricha *Marquand & Shaw* *, 177.
— hispidula *D. Don*, 178.
— — var. dentata *Franch.*, 178.
— — var. Doniana *Engl.*, 178.
— Hookeri *Engl. & Irmsch.* var. æquifolia *Marquand & Shaw* *, 178.
— imbricata *Royle*, 178.
— Jacquemontiana *Decne*, 178.
— Kingdonii *Marquand* *, 179.
— latiflora *Hook. fil. & Thoms.*, mentd., 179.
— Lychnitis *Hook. fil. & Thoms.*, mentd., 176.
— megalantha *Marquand* *, 179.
— montana *H. Sm.*, 180.
— — f. humilis *H. Sm.*, 180.
— — var. subdioica *Marquand* *, 180.

Saxifraga muricola *Marquand & Shaw* *, 180.
— var. brachypetala *Marquand & Shaw* *, 180.
— — var. quinquenervis *Marquand & Shaw* *, 180.
— pallida *Wall.*, 180.
— pasumensis *Marquand & Shaw* *, 180, 181.
— — f gracilis *Marquand & Shaw* *, 181.
— perpusilla *Hook. fil. & Thoms.*, 181.
— pseudo-hirculus *Engl.*, 181.
— pseudo-pallida *Engl. & Irmsch.*, 181.
— punctulata *Engl.*, 181.
— saginoides *Hook. fil. & Thoms.*, 181.
— sanguinea *Franch.*, mentd , 181.
— sediformis *Engl. & Irmsch.*, mentd., 177.
— signata *Engl. & Irmsch.*, mentd., 182.
— signatella *Marquand* *, 182.
— Stella-aurea *Hook. fil. & Thoms.*, 182.
— — var. ciliata *Marquand & Shaw* *, 182.
— taraktophylla *Marquand & Shaw* *, 182.
— umbellulata *Hook. fil. & Thoms.*, 183.
— — f. pectinata *Marquand & Shaw* *, 181, 183.
— Vilmoriniana *Engl. & Irmsch.*, mentd., 177, 182.
— viscidula *Hook. fil. & Thoms.*, mentd., 176.
Scabiosa columbaria, 118.
— Hookeri *C. B. Clarke*, 189.
— Succisa, 118.
Scaveola Lambertiana *De Vriese*, mentd., 440.
Schedonorus *Beauv.*, 76.
— littoralis *Raoul*, 76.
Schefflera Delavayi *Harms*, mentd., 186.
— Wardii *Marquand & Shaw* *, 186.
Schweyggera nemorosa E. Mey., 27.
Scilla bifolia, 118, 636.
— — (white-flowered form), 636.
Scopolia lurida *Dunal*, 209.
Scrophularia aquatica, 636.
— nodosa, 118.
— Przewalskii *Batal.*, 210.
Scytosiphon lomentarius *J. Ag.*, 235, 237.
Secale cereale, 118.
— — var. hybernum, 636.
Sedum acre, 118, 636.
— album, 118, 636.
— crassipes *Wall.*, 184.
Sedum humile *Hook. fil. & Thoms.*, 184.
— platysepalum *Franch.*, 184.
roseum, 636.
— rotundatum *Hemsl.* var. oblongatum *Marquand & Shaw* *, 184.
— rupestre, 636.
— Smithii *Raymond-Hamet*, 184.
— sp. n., 184.
— Telephium, 118.
— — var. album, 636.
— — var. purpureum, 636.
Sempervivum tectorum, 118, 636.
Senecio, 259-261.
— *armerifolius* Franch., 291.
— *arnicoides* Wall., 288.
— — var. *frigida* Hook. fil., 293.
— *Atkinsoni* C. B. Clarke, 280.
— *atroviolaceus* Franch., 286.
— *Benthamianus* Franch., 271.
— *cacaliæfolius* var. *Atkinsoni* Hook. fil., 280.
— *calthæfolius* Hook. fil., 280.
— *campanulatus* Franch., 270.
— *Clarkeanus* Franch., 300.
— *Delavayi* Franch., 287.
— *discoideus* Franch., 297.
— drukensis *Marquand & Shaw* *, 191.
— *Feddei* Lévl., 280.
— *ficariæfolius* Lévl. et Van, 280.
— *Fletcheri* Hemsl., 293.
— Fuchsii, 636.
— *goringensis* Hemsl., 293.
— *Helianthus* Franch., 295.
— *himalayensis* Franch., 296.
— Jacobæa, 118, 636.
— *kansuensis* Franch., 299.
— *kialensis* Franch., 285.
— *lagotis* W. W. Sm., 291.
— *Léveilléi* Vaniot, 280.
— *liatroides* C. Winkl., 292.
— *Maximowiczii* Franch., 293.
— *nephelogetus* Franch., 273.
— *nimborum* Franch., 280.
— *nobilis* Franch., 292.
— *oblongatus* Franch., 287
— *oreotrephes* W. W. Sm., 286.
— *paberensis* Franch., 293.
— paucinervis *Dunn* var. brachylepis *Marquand & Shaw* *, 192.
— *phœnicochætus* Franch., 279.
— *plantaginifolius* Franch., 291.

Senecio *pleurocaulis* Franch., 290.
— *Prattii* Hemsl., 285.
— *Principis* Franch., 283.
— *reniformis* Wall., 277.
— *retusus* Wall., 278.
— *rumicifolius* J. R. Drumm., 289.
— *saccoso-flabellatus* Lévl., 280.
— *scytophyllus* Diels, 288; mentd., 289.
— *sessilifolius* Sch. Bip., 300.
— *sikkimensis* Franch., 280.
— *tatsienensis* Franch., 290.
— *trichopoda* Lévl., 287.
— *venatus* Franch., 275.
— vulgaris, 118, 636.
Sertularia, mentd., 234.
Setaria italica, 636.
Shorea robusta, 423, 428.
Silene vulgaris, 118.
Silybum Marianum, 118, 636.
Sinapis alba, 118, 636.
— arvensis, 118, 636.
Sison Amomum, 636.
Sisymbrium officinale, 118, 636.
— Sophia, 118, 636.
Sisyrinchium angustifolium *Mill.*, 51.
Sium angustifolium, 636.
— Sisarum, 636.
Smilax aspera, 636.
Smyrnium Olusatrum, 636.
Solanum Melongena, 636.
— nigrum, 118, 636.
Sonchus arvensis, 636.
— asper, 636.
— oleraceus, 636.
Sophora Moorcroftiana *Benth.*, 173.
Sorbus domestica, 636.
— Rehderiana *Koehne*, 176.
Sorghum vulgare, 636.
Sparaxis atropurpurea *Klatt*, 45.
— bulbifera *Ker*, 45.
— fimbriata *Ker*, 45.
— grandiflora *Klatt*, mentd., 45.
Spartium junceum, 636.
Spencera parviflora *Stapf*, 175.
Sphacelaria cirrhosa *Ag.*, 237.
— — var. fusca *H. & B.*, 237.
Spinacia oleracea, 636.
Spiræa bella *Sims*, 174.
Spiranthes spiralis, 118.
Spirulina tenuissima *Kütz.*, 236.
Spondias mangifera, 419, 425, 426, 428, 430, 431.
Sprague, T. A., The Herbal of Otto Brunfels, 79-124.
Sprague, T. A., & Nelmes, E., The Herbal of Leonhart Fuchs, 545.
Stachys germanica, 636.
— officinalis, 118, 636.
— —, flore albo, 118.
— recta, 636.
Stellaria aquatica, 118.
— Holostea, 636.
— media, 118, 636.
Stereum hirsutum *Fr.*, 418, 422, 423.
Strobilanthes alatus *Nees*, 215.
— capitatus *T. Anders.*, 215.
— sp. n., 215.
Strychnos, mentd., 140, 141, 147.
Succisa pratensis, 118, 636.
Summerhayes, V. S., A Revision of the Australian Species of Frankenia, 337-387.
Swertia *codonopsidoides* Burkill, 207.
— *deltoidea* Burkill, 207.
— hispidicalyx *Burkill* f. subglabra *Marquand* *, 208.
— obtusa *Ledeb.*, mentd., 208.
— Wardii *Marquand* *, 208.
Symphytum officinale, 636.
— — var. ochroleucum, 118.
— — var. purpureum, 118.
Symploca hydnoides *Kütz.*, 236, 253.
Synnotia bicolor *Sweet*, 20.

Tæniopteris †, 397.
— vittata *Br.*†, 394, 405, 411.
Tagetes patula, 636.
Tamarindus indica, 419, 421, 422, 425.
Tanacetum Kennedyi *Dunn*, 190.
— myrianthum *Franch.* var. Wardii *Marquand & Shaw* *, 190.
— vulgare, 118, 636.
Taraxacum officinale, 118, 636.
Taxodium distichum, mentd., 445, 456, 457, 460, 462, 463.
— sempervirens, mentd., 444, 445, 453, 454, 457, 459, 462, 463.
Taxus Wallichiana *Zucc.*, 224.

Tetrastigma serrulatum *Planch.* var. subobtectum *Kurz*, 169.
Teucrium Botrys, 636.
— Chamædrys, 636.
— flavum, 636.
— Scordium, 636.
Thalictrum alpinum *Linn.*, 153.
— Chelidonii *DC.*, 153.
— diffusiflorum *Marquand & Shaw**, 153.
— leuconotum *Franch.*, 154.
Thomas, H. Hamshaw, Further Observations on the Cuticle Structure of Mesozoic Cycadean Fronds, 389-416.
Thuja chilensis, mentd., 453, 454, 457, 459, 462, 463.
— dolobrata, mentd., 446, 449, 455, 457, 460, 462, 463.
— pendula, mentd., 445, 454, 457, 459, 462, 463.
— pensilis, mentd., 454, 457, 459, 462, 463.
— plicata, mentd., 453, 454, 457, 459, 462, 463.
Thymus Serpyllum, 118, 636.
— vulgaris, 118, 636.
Tilia europæa, 636.
Toichogonia cosmopolita, 345, 346.
— isolata, 345, 346.
Tragopogon porrifolius, 118.
— pratensis, 636.
Trailliella intricata *Batt.*, 234, 235, 240, 247.
Trametes cingulata *Berk.*, 424.
— gibbosa *Fr.*, 417, 418, 434.
— lactinea *Berk.*, 426, 428-430, 433-435.
Trichonema caulescens *Ker*, mentd., 44.
— cruciatum *Ker*, mentd., 45.
— ochroleucum *Ker*, mentd., 45.
— speciosum *Ker*, mentd., 46.
Trifolium arvense, 636.
— montanum, 636.
— pratense, 118, 636.
— repens, 118.
Trigonella cærulea, 636.
— corniculata, 636.
— Fœnum-græcum, 636.
Trigonotis rotundifolia *Benth.*, 209.
Trillium, 228.
Tristania *R. Brown*, 662.
Tristania bournensis *Bandulska* * †, 666, 669.
— burmannica, 662, 663, 665, 666; mentd., 668, 670.
— conferta, 662, 663.
— laurina, 662, 663, 665, 666; mentd., 668-670.
— Maingayi, 662, 665, 666.
— neriifolia, 662, 663, 665, 666.
— obovata, 663.
— pectioides, 662, 663.
— suaveolens, 662, 663, 665.
— toscana *Bandulska* * †, 668.
Triticum hybernum, 118.
— monococcum, 636.
— Spelta, 118, 636.
— turgidum, 636.
— vulgare, 636.
Tritonia Bakeri *Klatt*, 25.
— crispa *Ker*, 21; mentd., 48.
— crocata *Ker*, 46.
— deusta *Ker*, 46.
— lancea *N. E. Brown**, 48.
— laxifolia *Benth.*, 47.
— lineata *Ker*, 49.
— longiflora *N. E. Brown**, 24, 25.
— *longiflora* Ker, 25.
— scillaris *Baker*, 49.
— securigera *Ker*, 50.
— stricta *Klatt*, 48.
— undulata *Baker*, 46.
— *unguiculata* Baker, 27.
Trollius pumilus *Don*, 156.
Tsuga, 224.
— Brunoniana *Carrière*, 224.
Tussilago, mentd., 261.
— Farfara, 118, 636.
Typha latifolia, 636.

Ulmus pumila *Linn.*, 220.
Ulva lactuca *Linn.* var. latissima *DC.*, 236.
Urginea maritima, 636.
Urtica dioica, 118, 636.
— pilulifera, 636.
— urens, 118, 636.

Vaccinium serratum *Wight* var. leucobotrys *C. B. Clarke*, 197.
— sikkimense *C. B. Clarke*, 198.

Valeriana officinalis, 119.
— — var. latifolia, 637.
— Phu, 637.
Vaucheria sp., 237.
Veratrum album, 637.
Verbascum Blattaria, 637.
— Lychnitis var. album, 637.
— nigrum, 637.
— phlomoides, 637.
— Thapsus, 119, 637.
Verbena officinalis, 119, 637.
Veronica agrestis, 637.
— Beccabunga, 119, 637.
— Chamædrys, 119, 637.
— hederæfolia, 637.
— officinalis, 637.
— serpyllifolia, 119.
— Teucrium, 119, 637.
Verrucaria maura, 251.
Viburnum, mentd., 140, 141, 147, 186, 187.
— cinnamomifolium, mentd., 140.
— Davidii, mentd., 140.
Vicia Faba, 119, 637.
— sativa *Linn.*, 119, 172, 637.
— sepium, 637.
Vieusseuxia *aristata* Houtt., 39.
— Bellendeni *Sweet*, 39, 40.
— *glaucopis* DC., 39.
— *spiralis* De la Roche, 38.
— tripetaloides *DC.*, mentd., 40.
— villosa *Spreng*, mentd., 38, 39.
Vinca minor, 119, 637.
Vincetoxicum officinale, 119, 637
Viola Delavayi *Franch.*, 163.
— dissecta *Ledeb.*, 163.
— distans *Wall.* var. acaulis *Hook. fil. & Thoms.*, 163.
— glaucescens *Oudem.*, 163
— hirta, 119.
— odorata, 119, 637.
— — var. β, 119.
— tricolor, 119, 637.
Viscum, 220.
— album, 637.
Vitis vinifera, 119, 637.
Vulpia *Gmel.*, 61.

Wahlbergella, mentd., 164.
Watsonia aletroides *Ker*, 26.
— angusta *Ker*, 17.
— Ardernei *Sander*, 25.
— brevifolia *Ker*, 25, 31.
— humilis *Miller*, 25, 31.
— iridifolia *Sweet*, mentd., 22.
— marginata *Ker*, 22.
— Meriana *Miller*, 25.
— Pillansii *Linn.*, 18.
— punctata *Ker*, 31.
— — var. *triticea* Baker, 32.
— roseo-alba *Ker*, 31.
— Schlechteri *L. Bolus*, 25.
— spectabilis *Schinz*, 33.
— subulata *Klatt*, 32.
Werneria Ellisii Hook. fil., 293.
— *nana* Benth., 300.
Witsenia, 55.
— *fruticosa* Ker, 47, 55.
— maura *Thunb.*, 55.
— *ramosa* Thunb., 47, 55.
Wound Reactions of Ankyropteris corrugata, 643–645.
Wurthia elegans Regel, 43.

Xanthium strumarium, 119, 637.
Xanthochrous radiatus, 428.

Zamites †, 395–397, 399.
— *Andraei* Stur. †, 399.
— boreale *Heer* †, 396.
— *gigas* †, 400.
— *Mandelslohi* Kurr. †, 400.
— Schmiedelii *Andrae* †, 397, 399.
— speciosus *Ekkorfat* †, 396.
Zanthoxylum oxyphyllum *Edgew.*, 108.
Zea Mays, 637.

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